

Appendix A-1 - Precipitation during Sampling Period

Figure A-1 presents a daily summary of precipitation data for Southeast Torrance, California from May 1, 2010 to March 30, 2011. Data was provided by Weather Underground station KCATORRA18. This station was identified as the location that recorded daily precipitation rates closest to the center of all six monitoring sites.

Data for this station is available at:

<http://www.wunderground.com/weatherstation/WXDailyHistory.asp?ID=KCATORRA18>

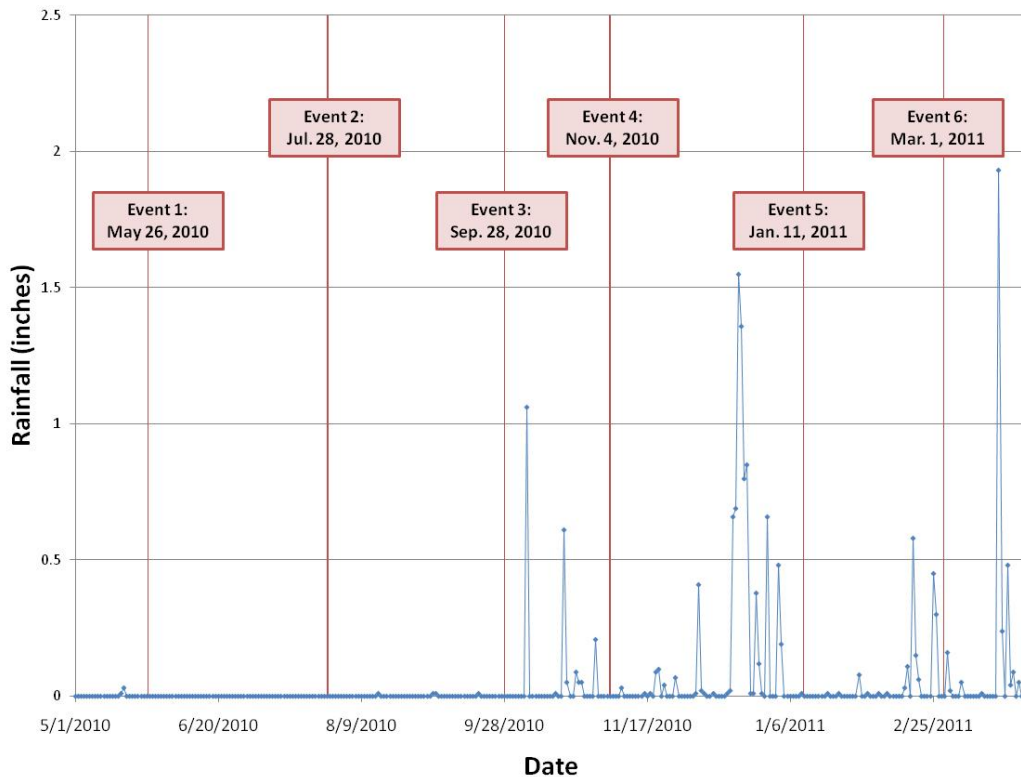


Figure A-1-1 - Precipitation Rates and Dates of Sampling

Event 6 (March 1, 2011) occurred between two wet weather events during an abnormally active wet season. Weather was monitored by the field staff leading up to the March 1 sampling event to ensure rain had ceased for a sufficient time prior to sampling. A rain event occurring prior to the sampling event ended on February 26, 2010 at 3:00 AM. This provided at least 72 hours of dry weather prior to the sampling commencing on March 1, 2011 at 9:35 AM, in accordance with standard operating procedure. Field crews also ensured that flows at all sites were not abnormally elevated, indicating precipitation influence on flow rates. Rain fell again on March 2, 2011 at 9:10 PM, after sampling had concluded. This did not impact the quality or collection of samples.

All other sampling events occurred significantly more than 72 hours after the most recent rainfall event.

Appendix A-2 - Dry Weather Sampling Sites



Figure A-2-1 - Site 10_ACAD viewed from above the manhole. Taken March 1, 2011 at 3:40 p.m.



**Figure A-2-2 - Site 10_EAST viewed from above the manhole.
Taken on January 11, 2011 at 12:30 p.m.**



**Figure A-2-3 - Site 3I_ASHB viewed from downstream looking upstream.
Taken on May 26, 2010 at 2:20 p.m.**



Figure A-2-4 - Downstream of Site 3I_NORMP. Taken on March 1, 2011 at 11:30 a.m.



Figure A-2-5 - Downstream of Site 30_VAND. Taken on January 11, 2011 at 10:15 a.m.



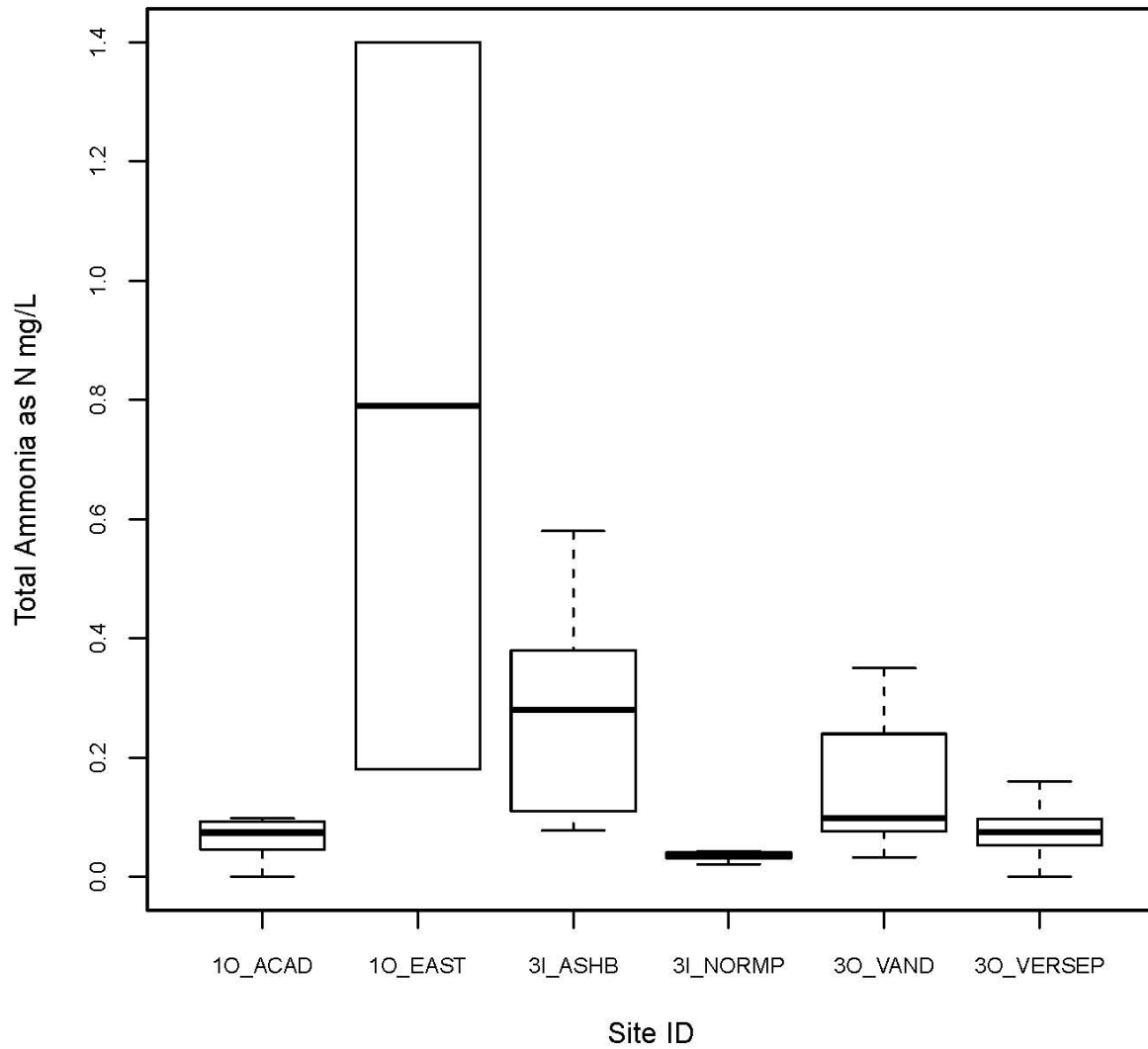
Figure A-2-6 - Downstream of Site 30_VERSEP. Taken on November 4, 2010 at 12:00 p.m.



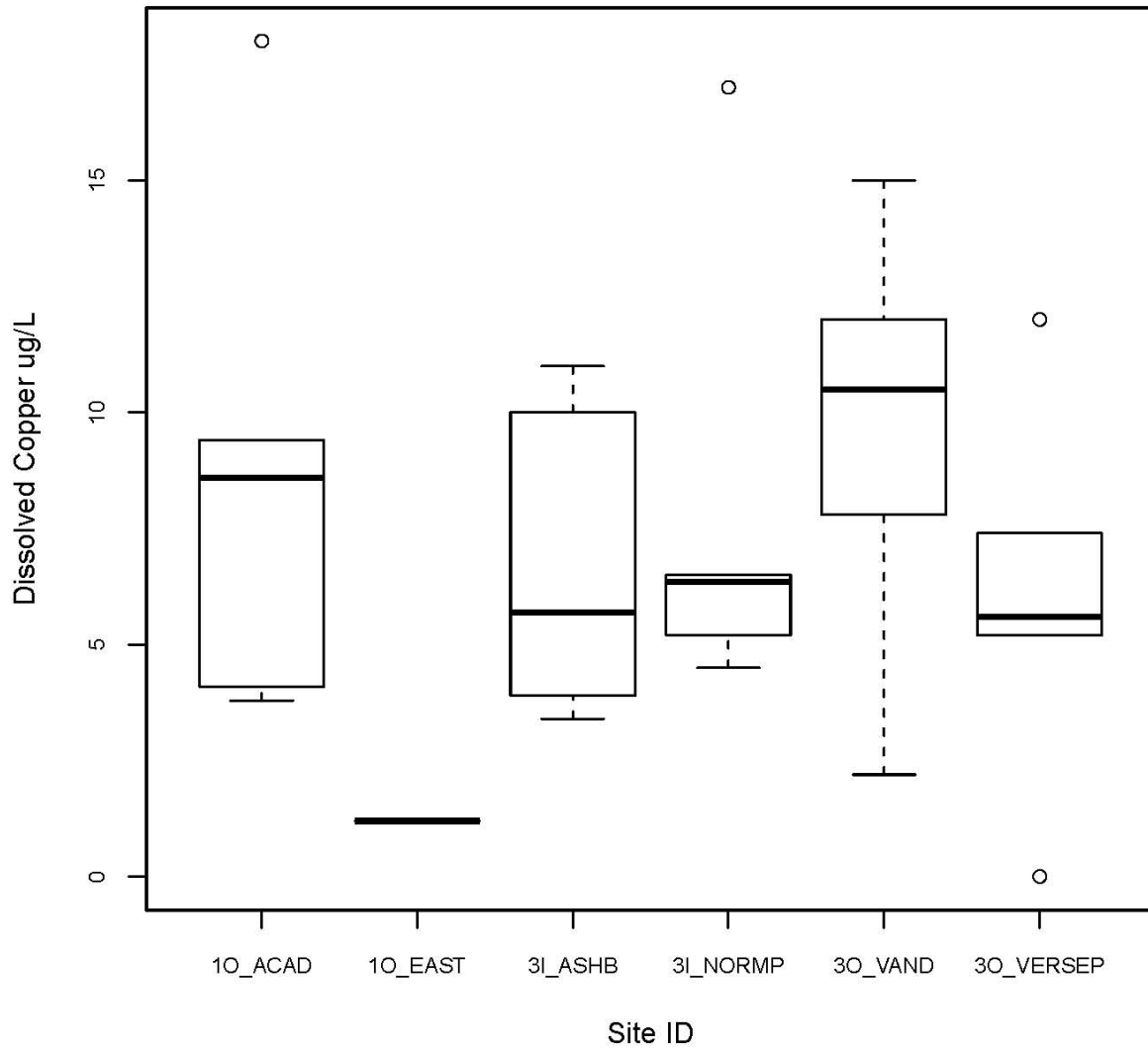
Figure A-2-7 - The South Coast Botanical Gardens Pond spillway viewed from upstream looking downstream. The site was observed during each sampling event to confirm no dry weather flow was discharging from the site. Taken on September 28, 2010 at 1:15 p.m.

Appendix B-1 - Water Quality Results Of Dry Weather Sampling Graphed by Site

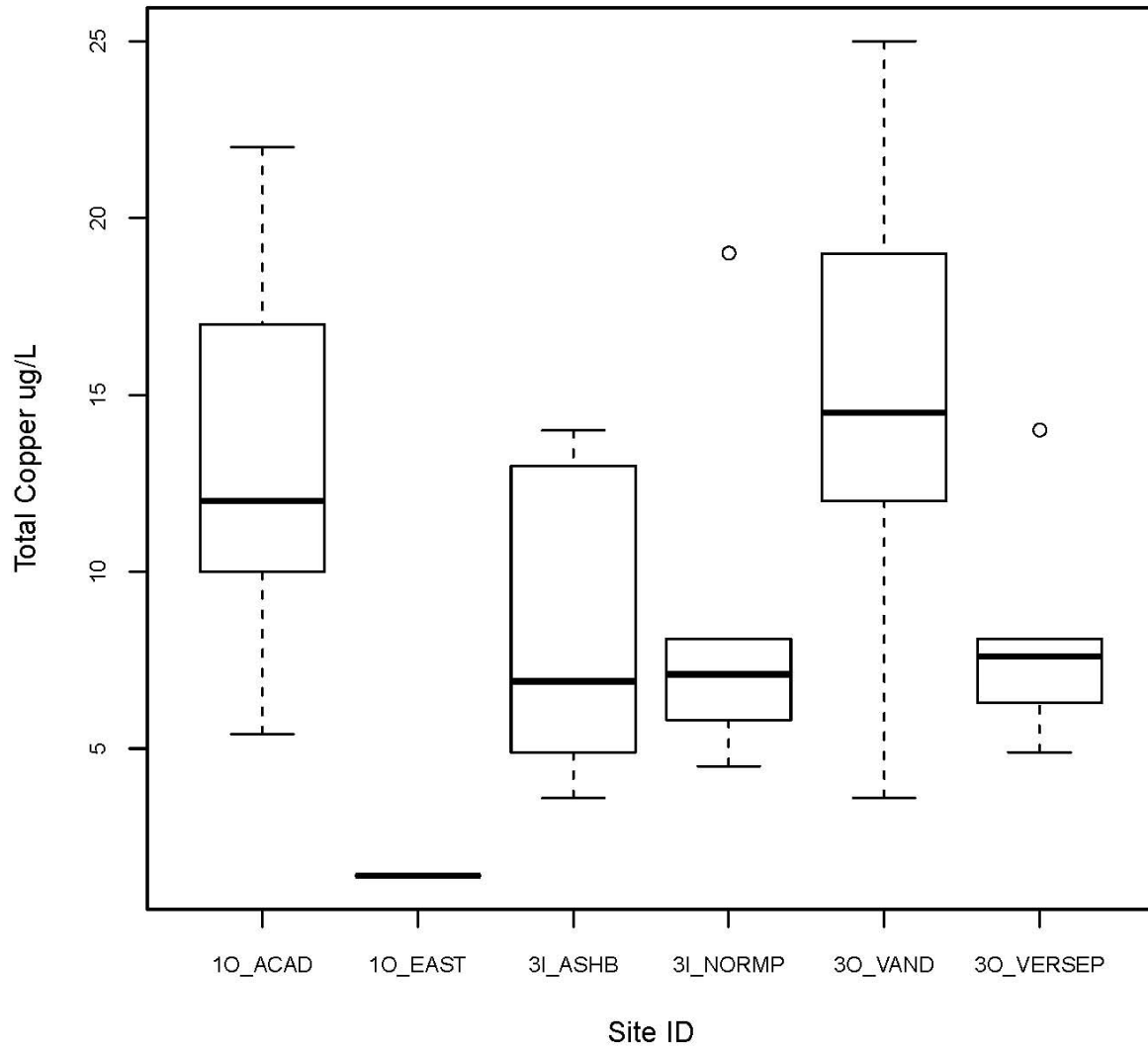
Total Ammonia as N across all Events



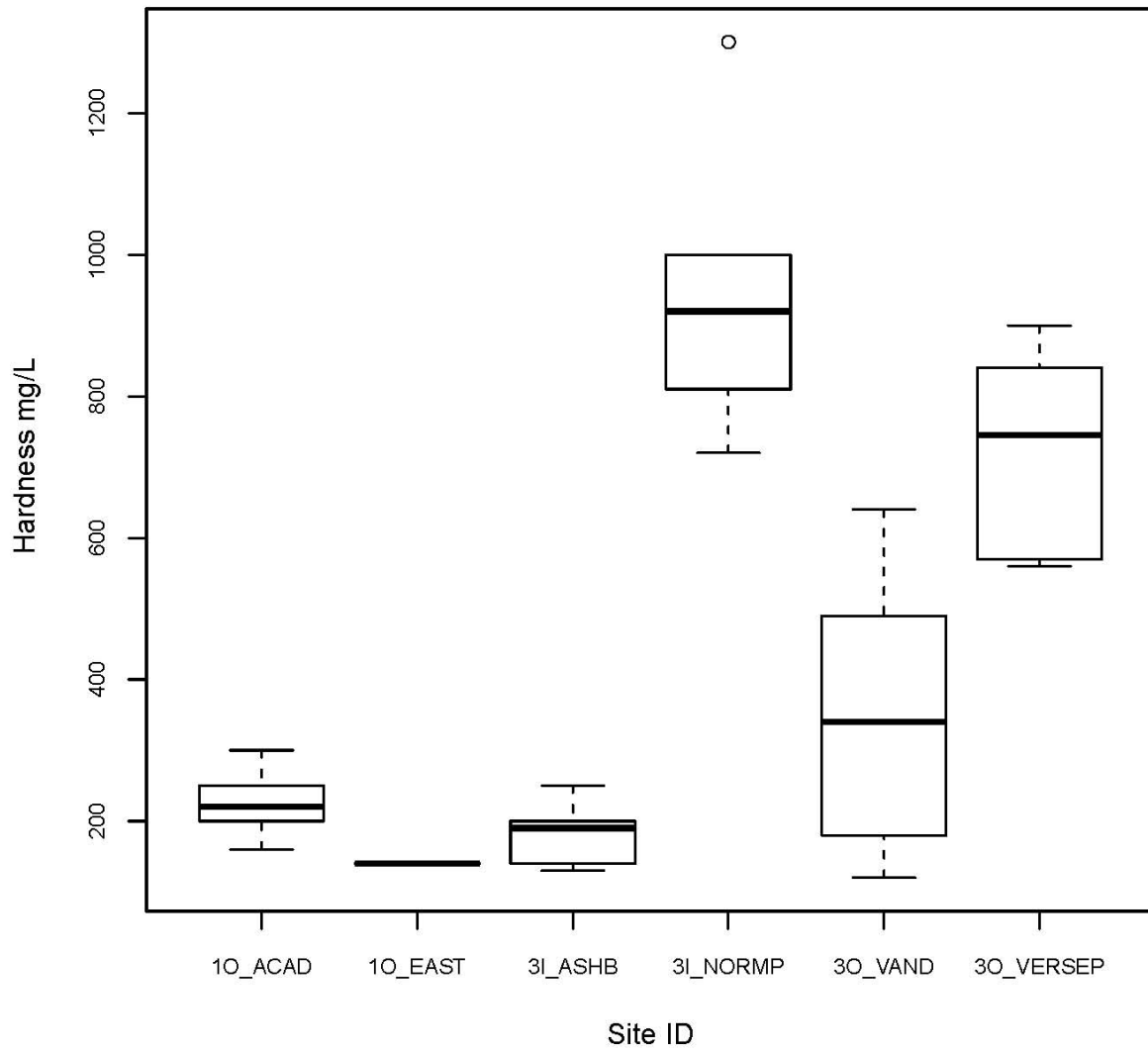
Dissolved Copper across all Events



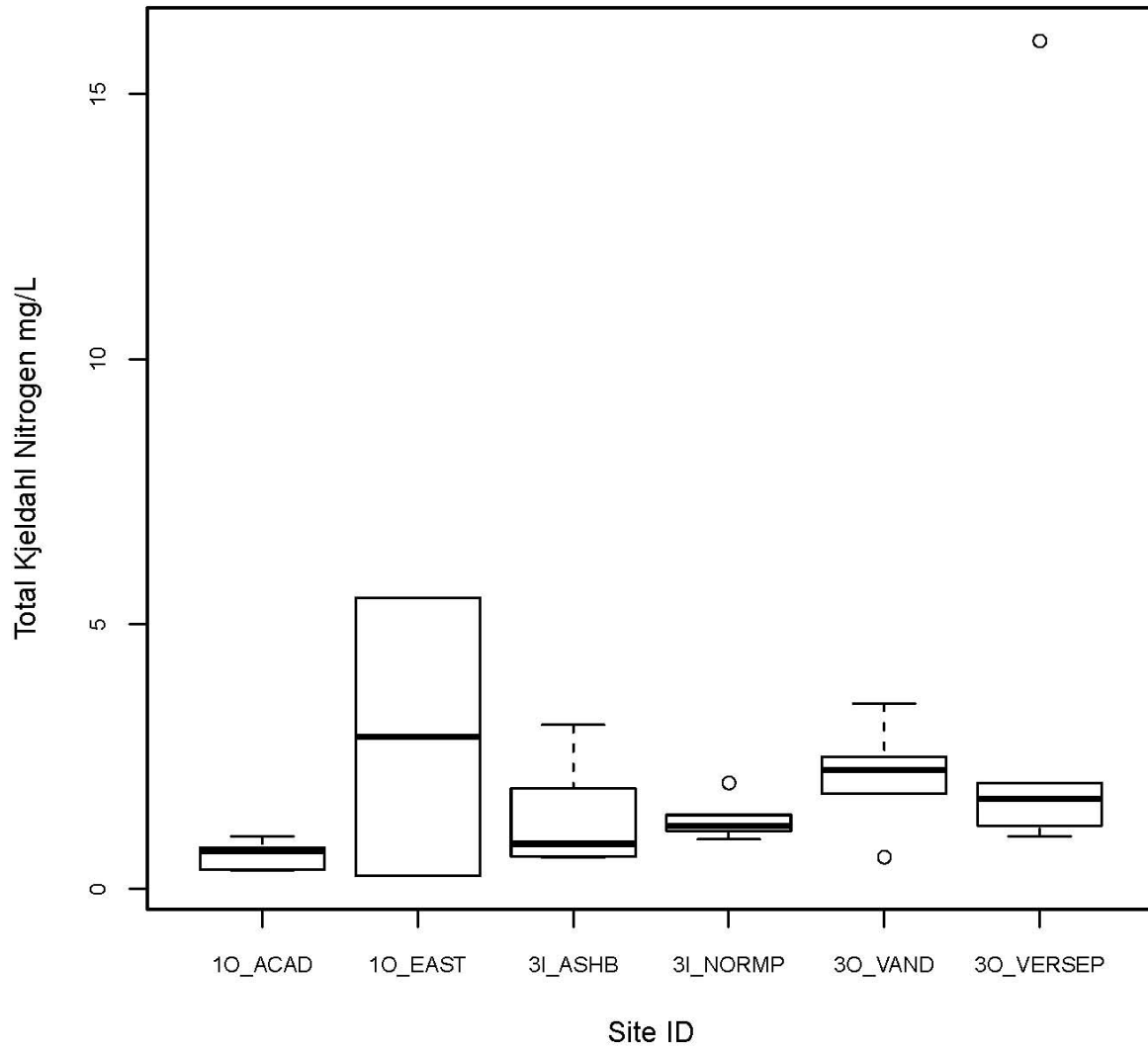
Total Copper across all Events



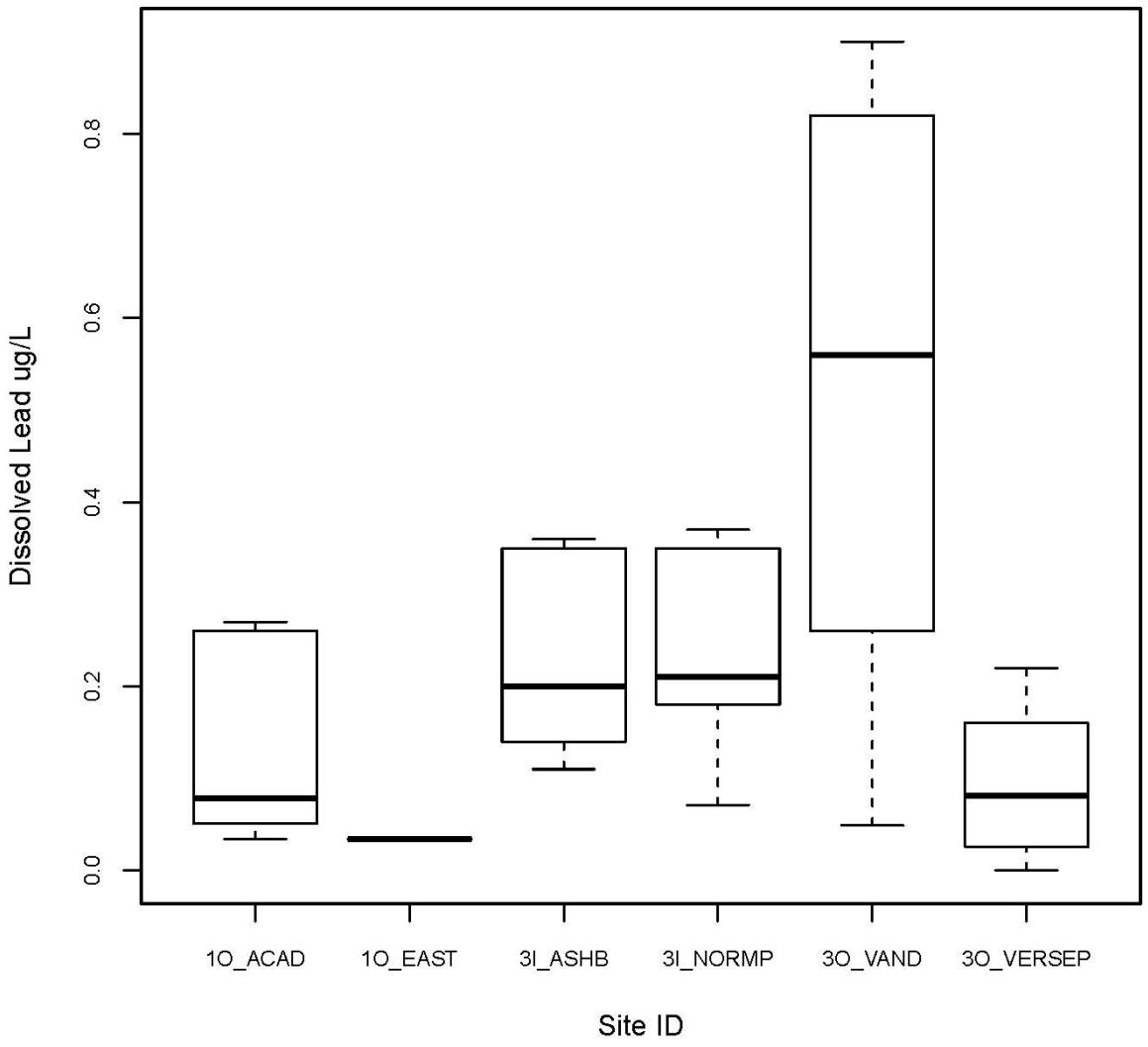
Hardness across all Events



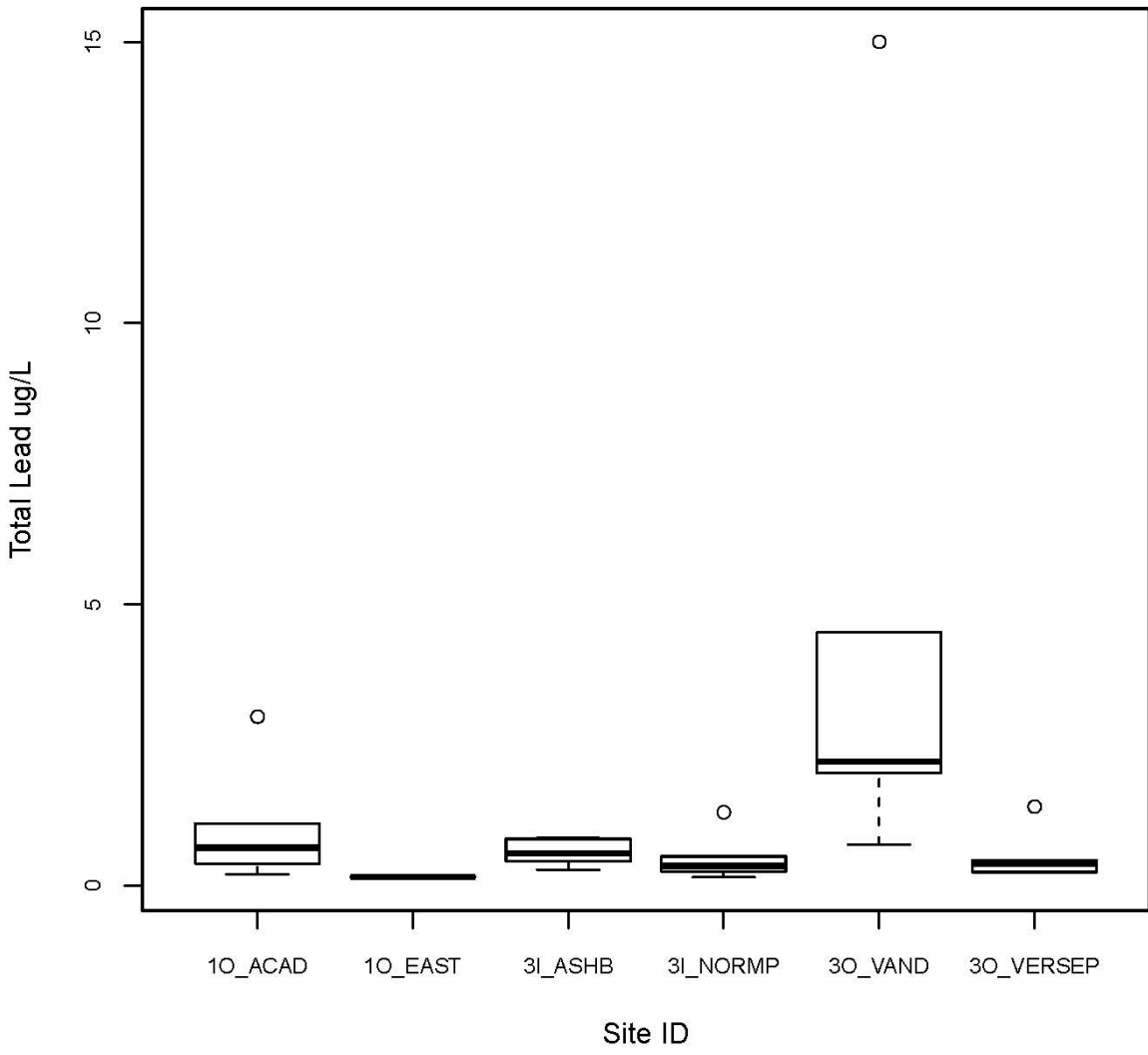
Total Kjeldahl Nitrogen across all Events



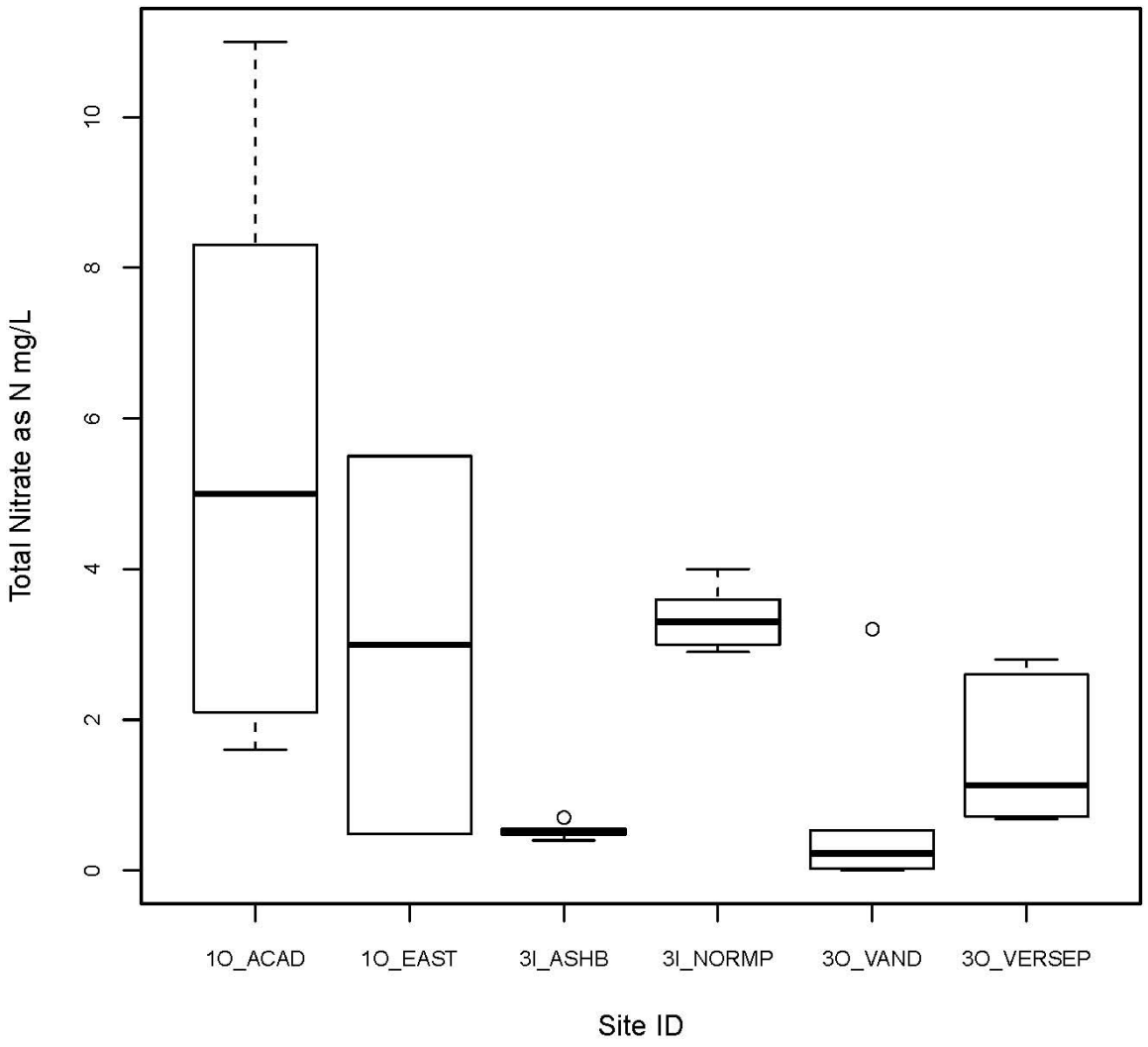
Dissolved Lead across all Events



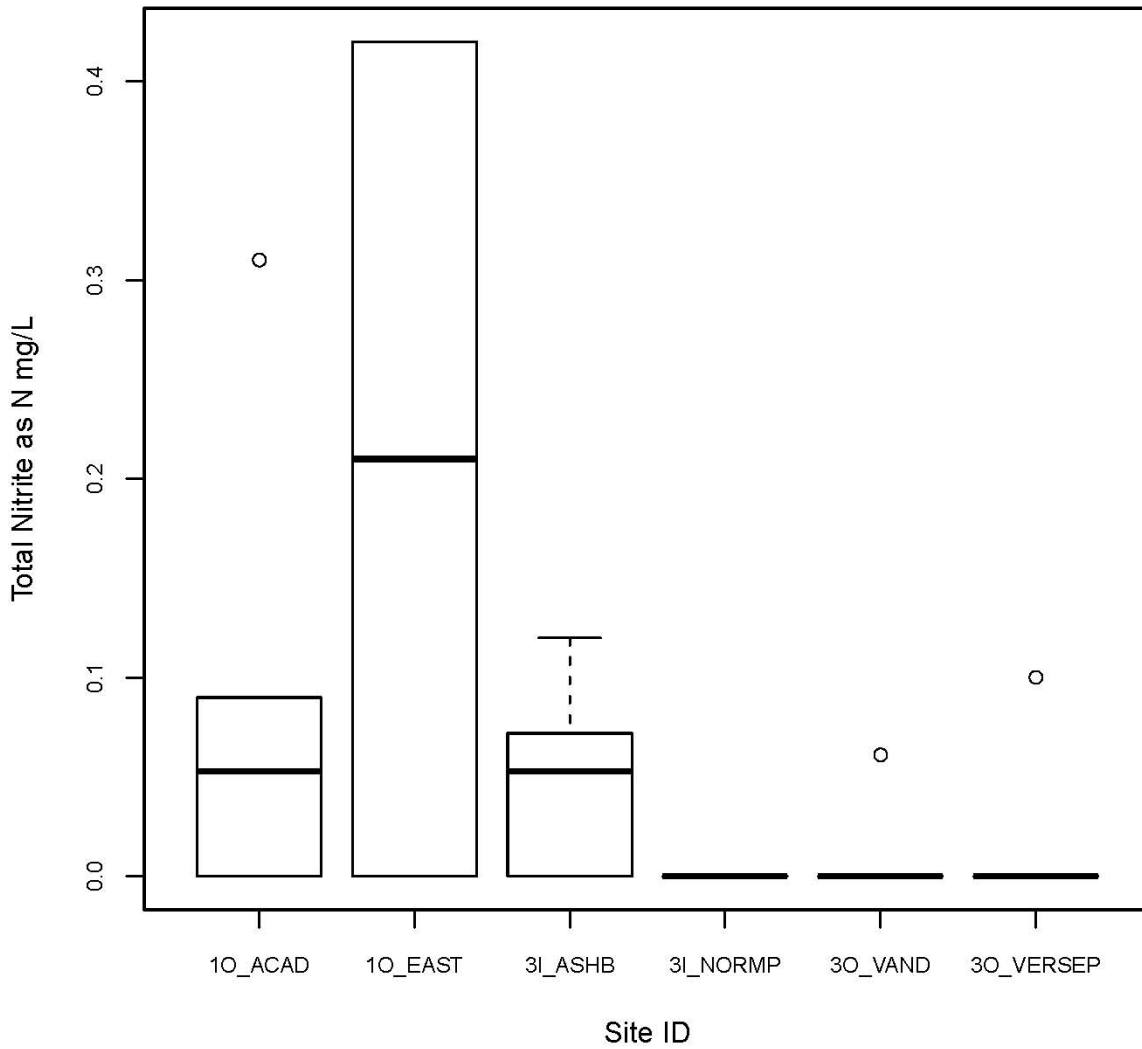
Total Lead across all Events



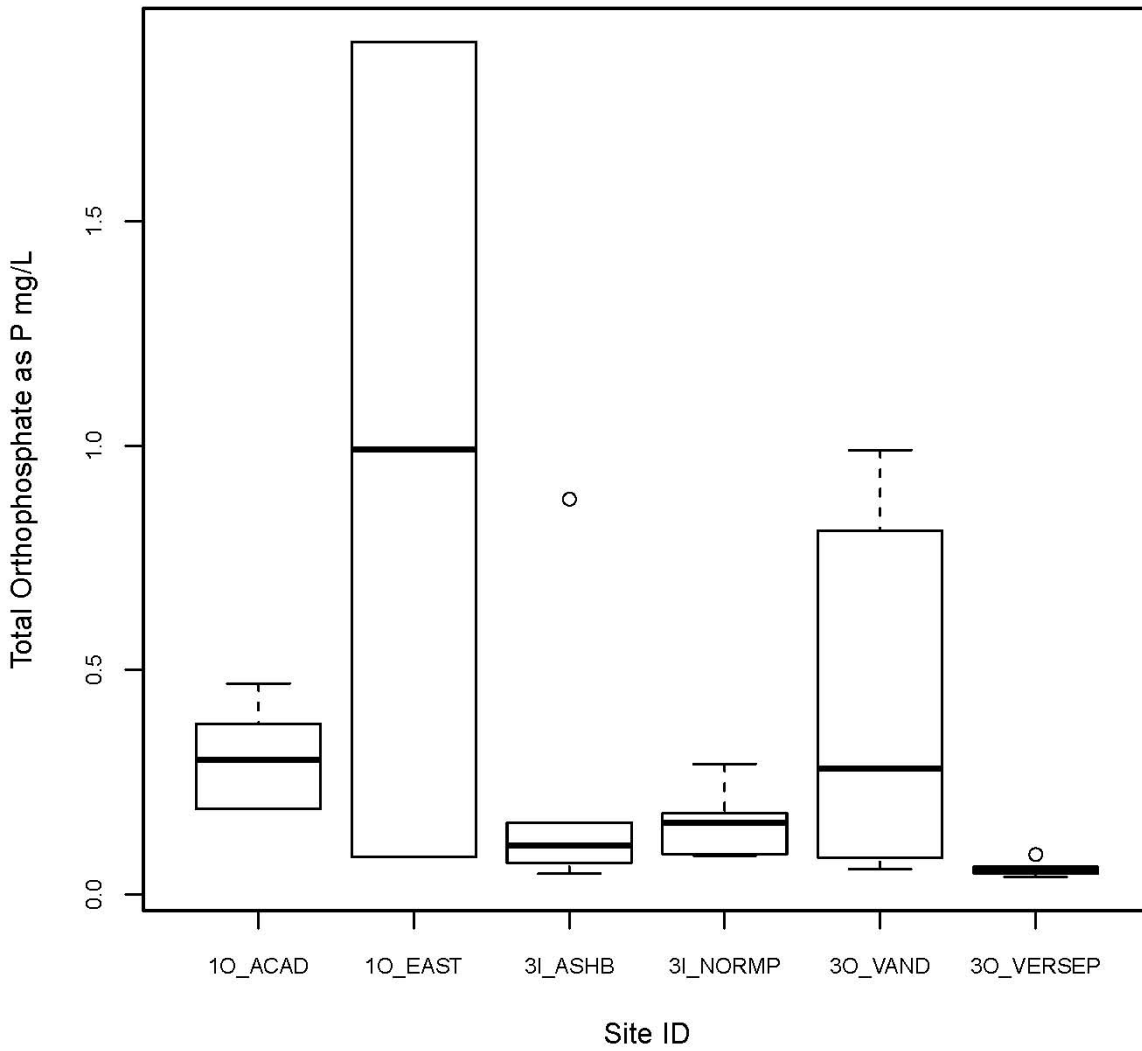
Total Nitrate as N across all Events



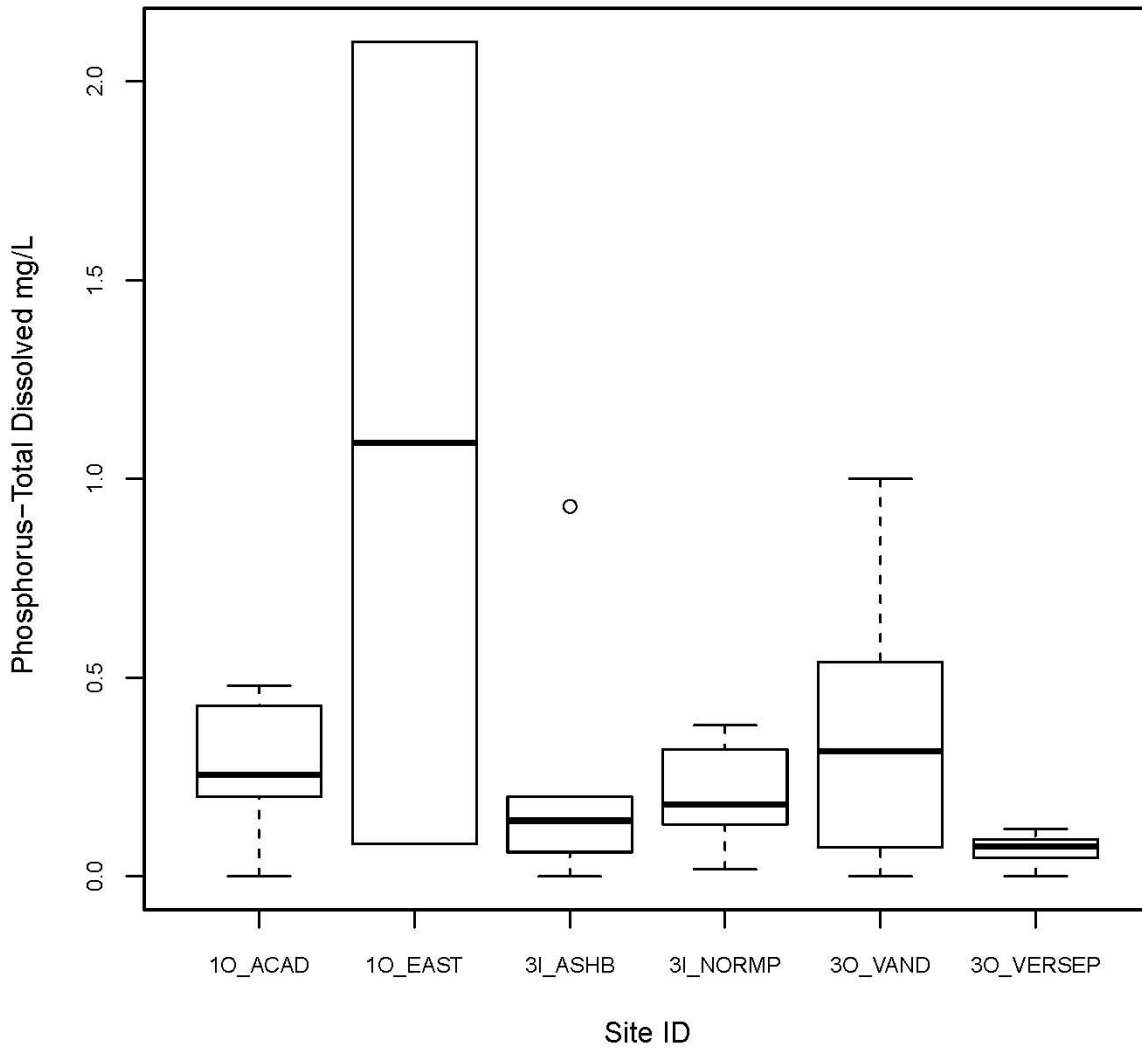
Total Nitrite as N across all Events



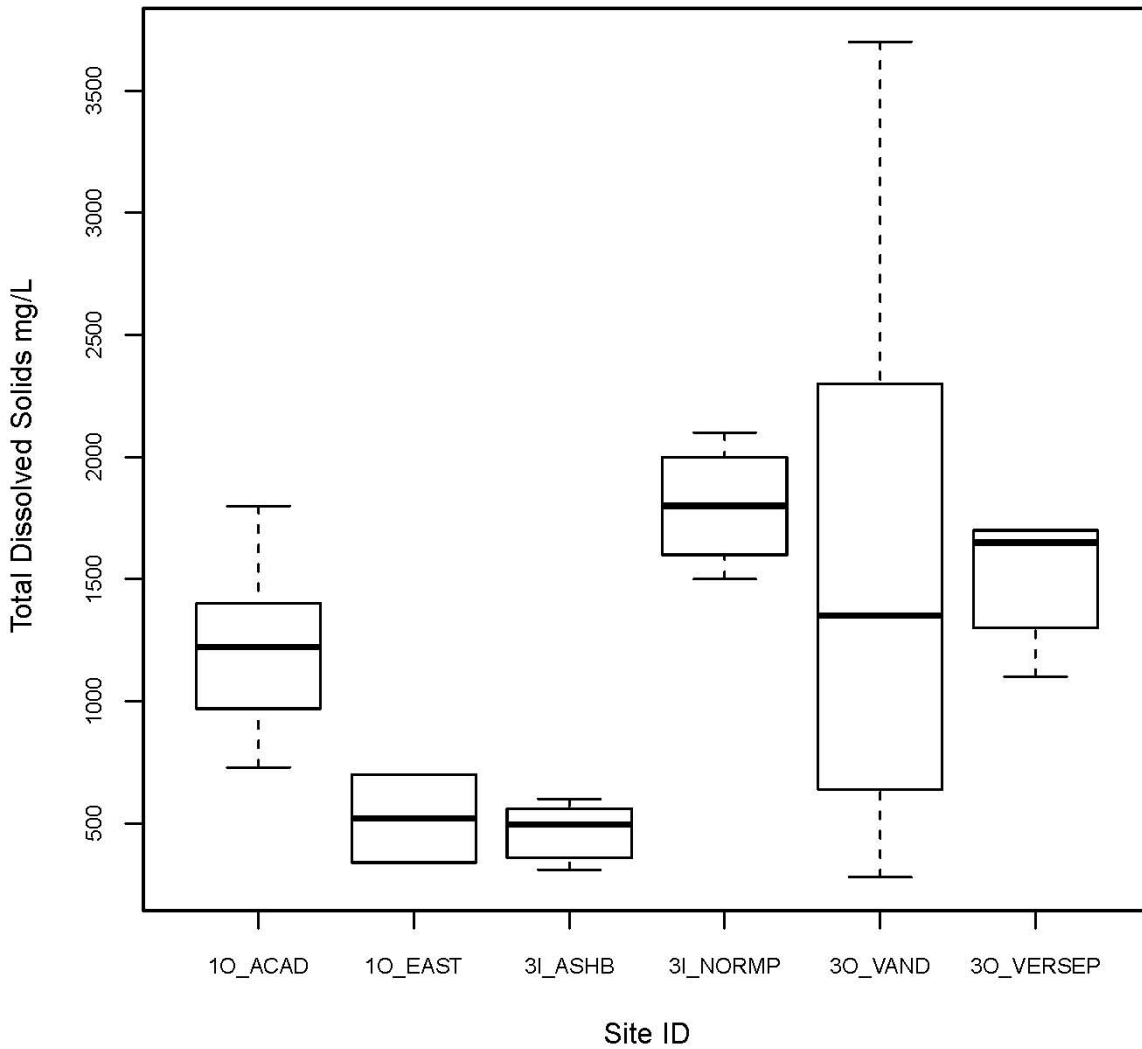
Total Orthophosphate as P across all Events



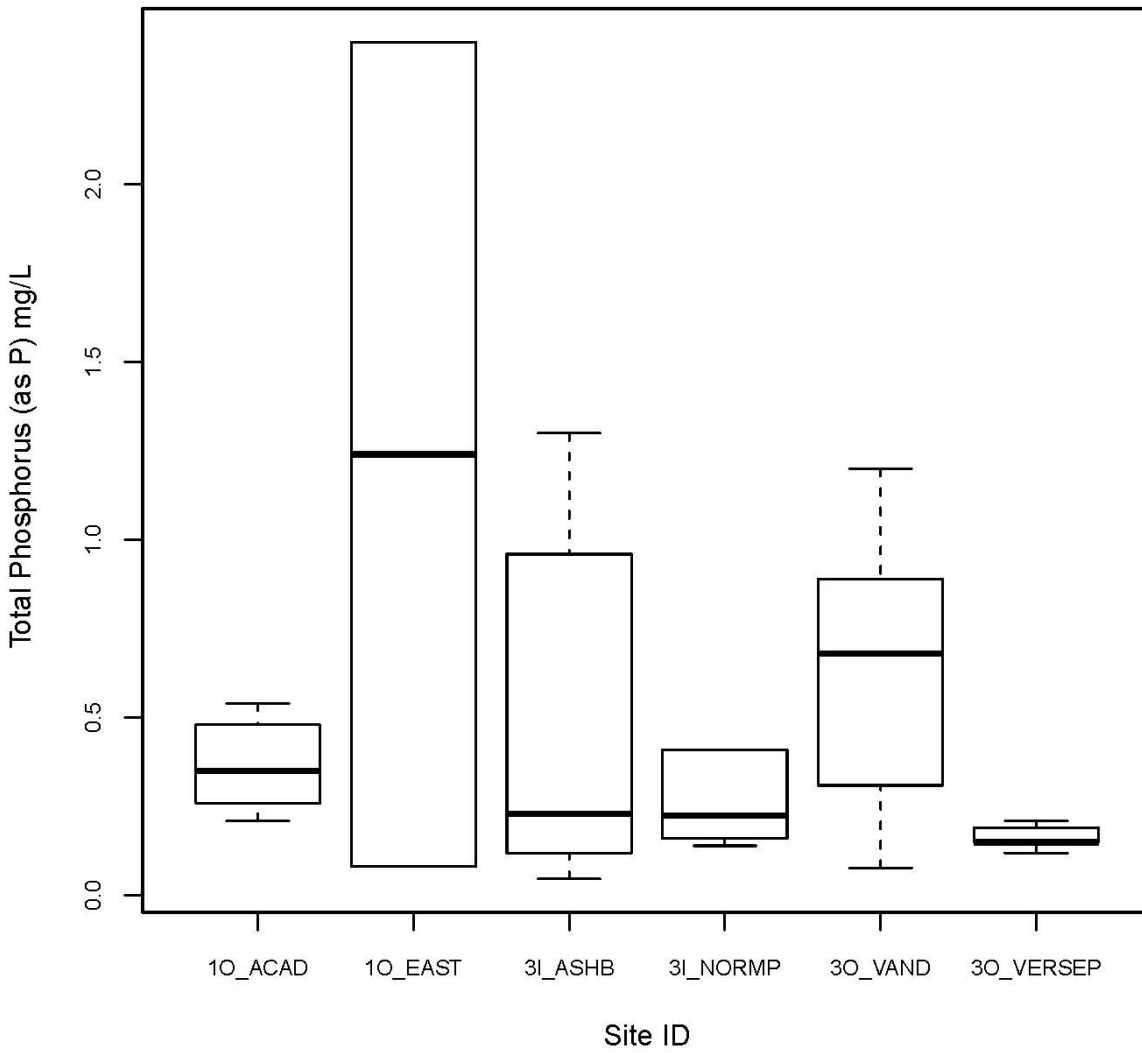
Phosphorus–Total Dissolved across all Events



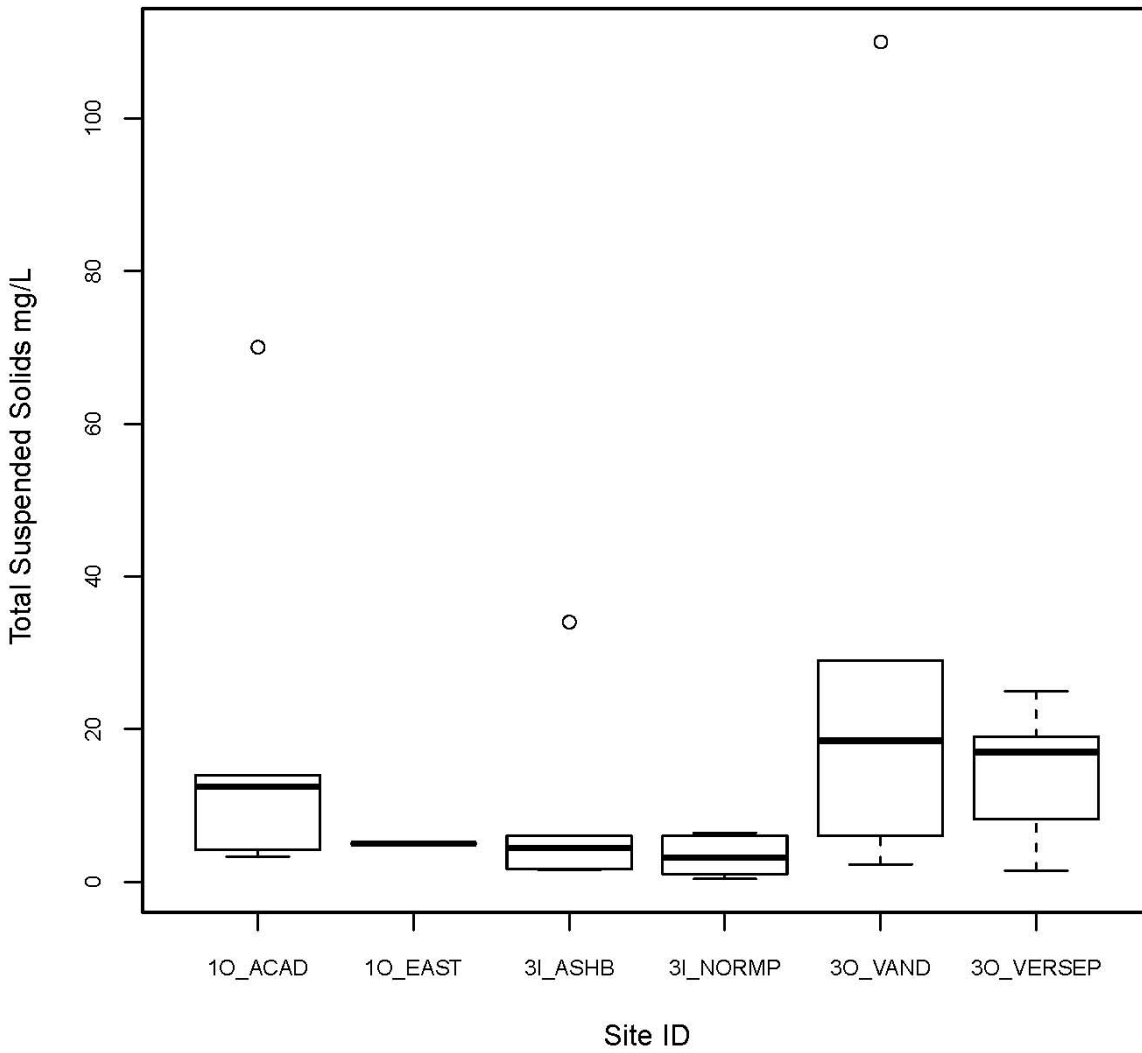
Total Dissolved Solids across all Events



Total Phosphorus (as P) across all Events

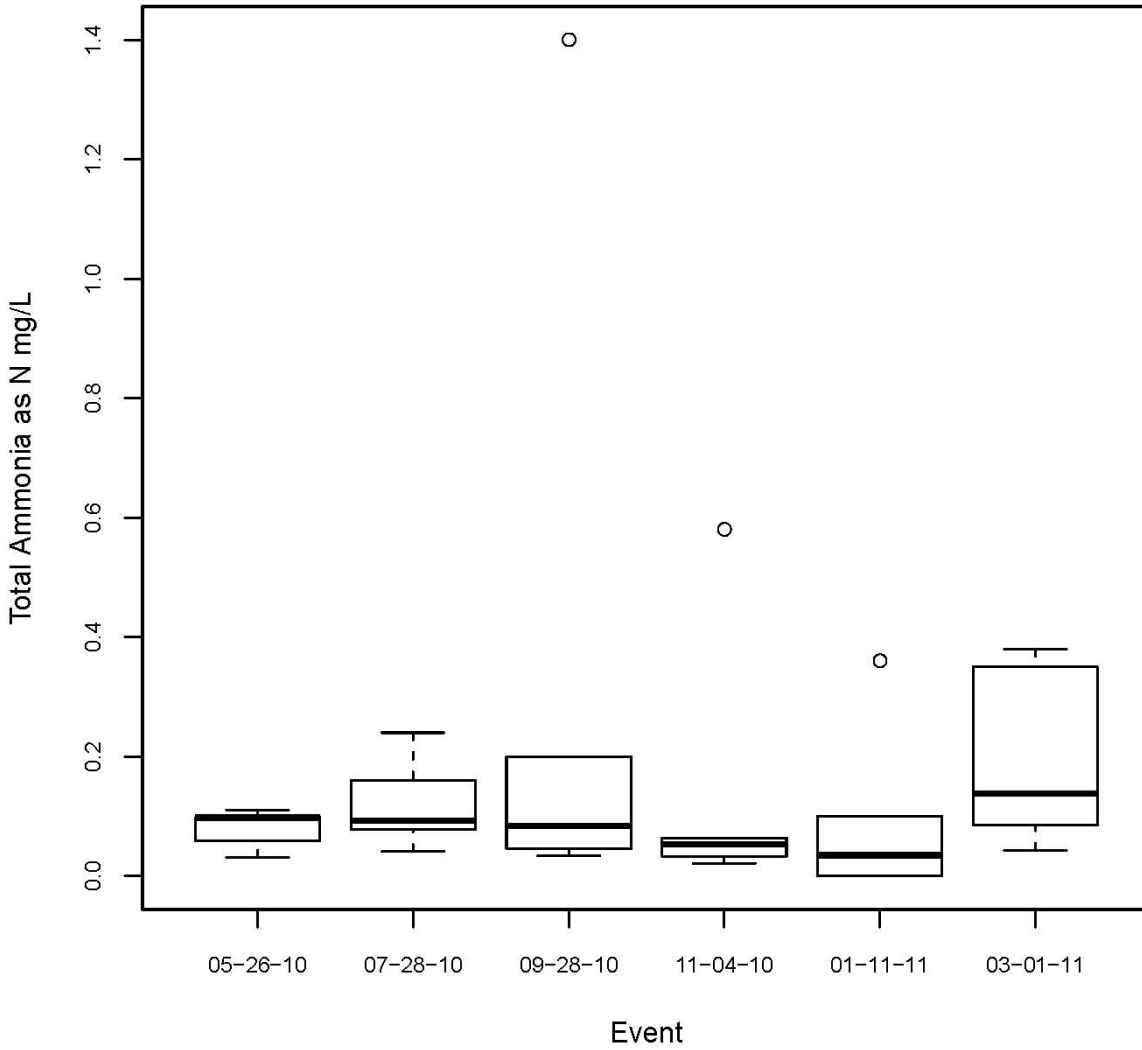


Total Suspended Solids across all Events

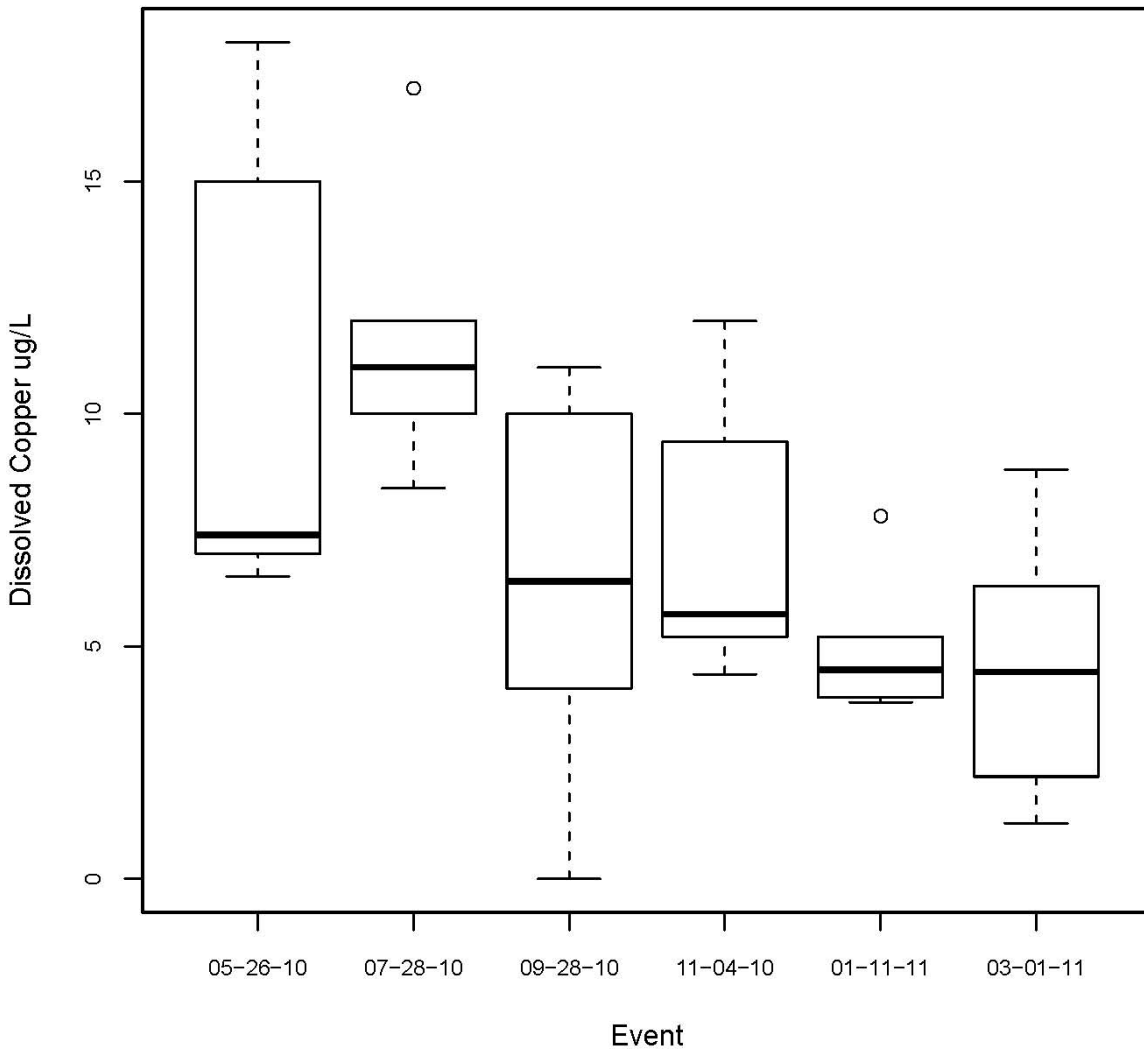


Appendix B-2 - Water Quality Results of Dry Weather Sampling Graphed by Event

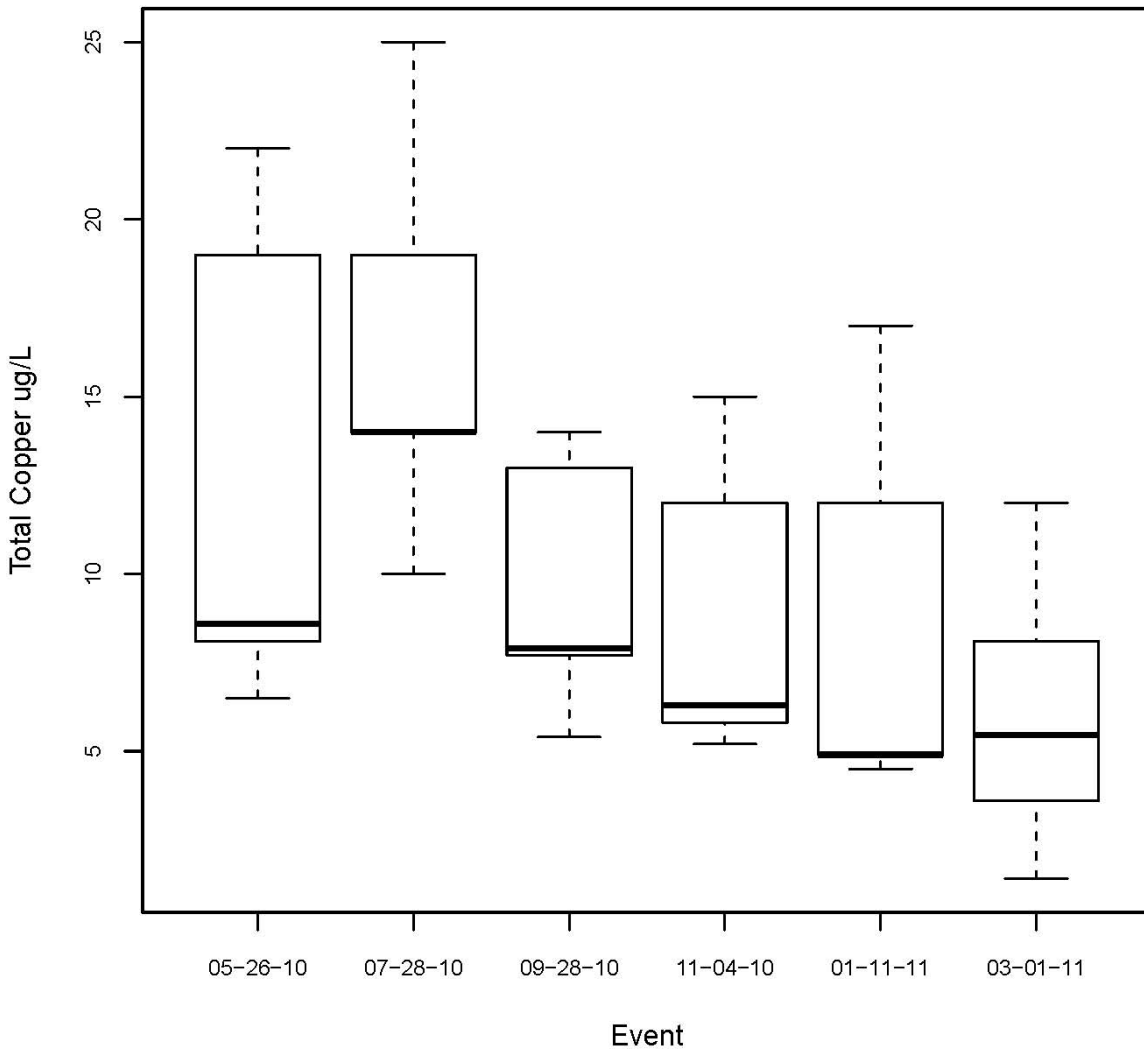
Total Ammonia as N across All Sites



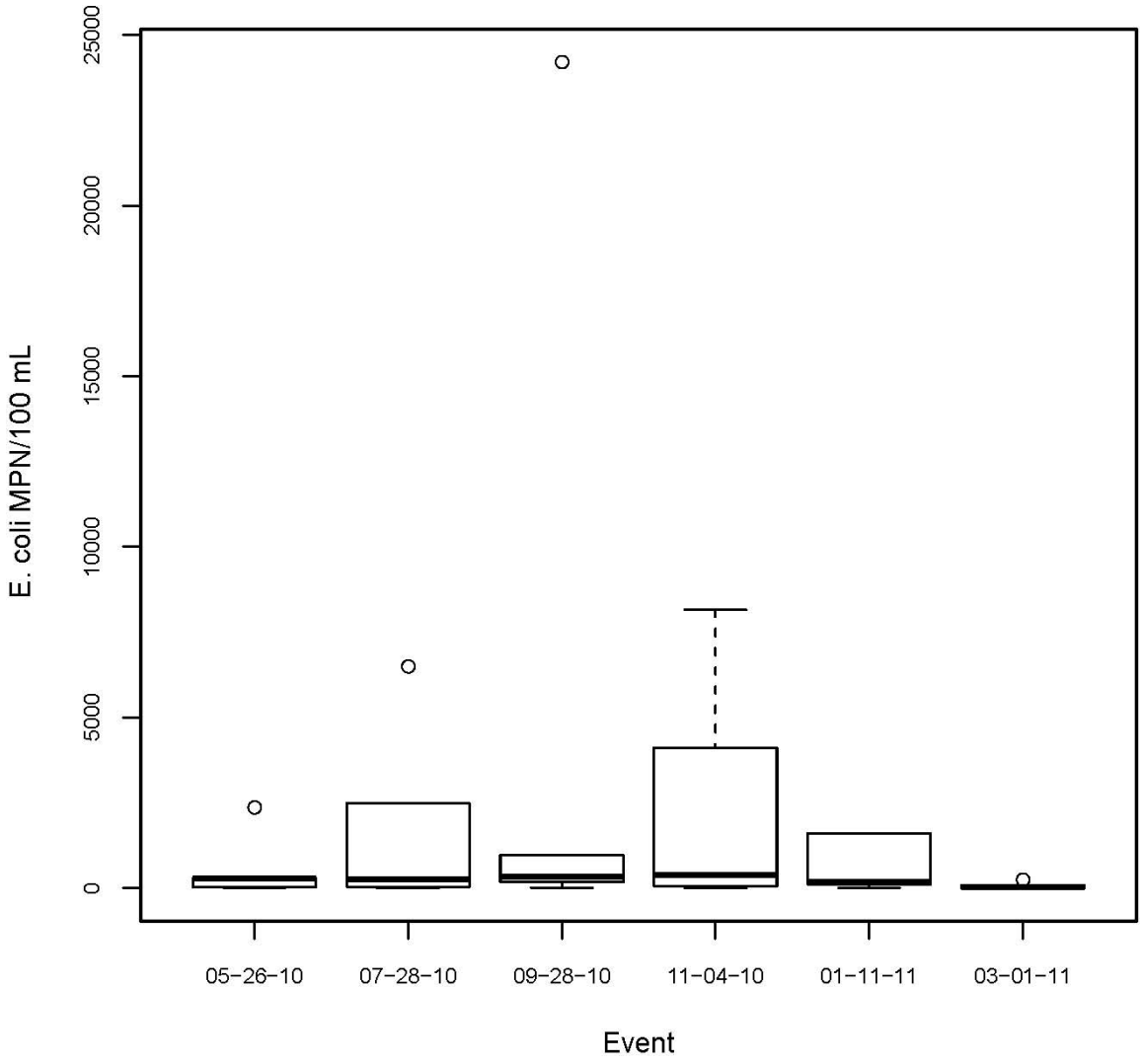
Dissolved Copper across All Sites



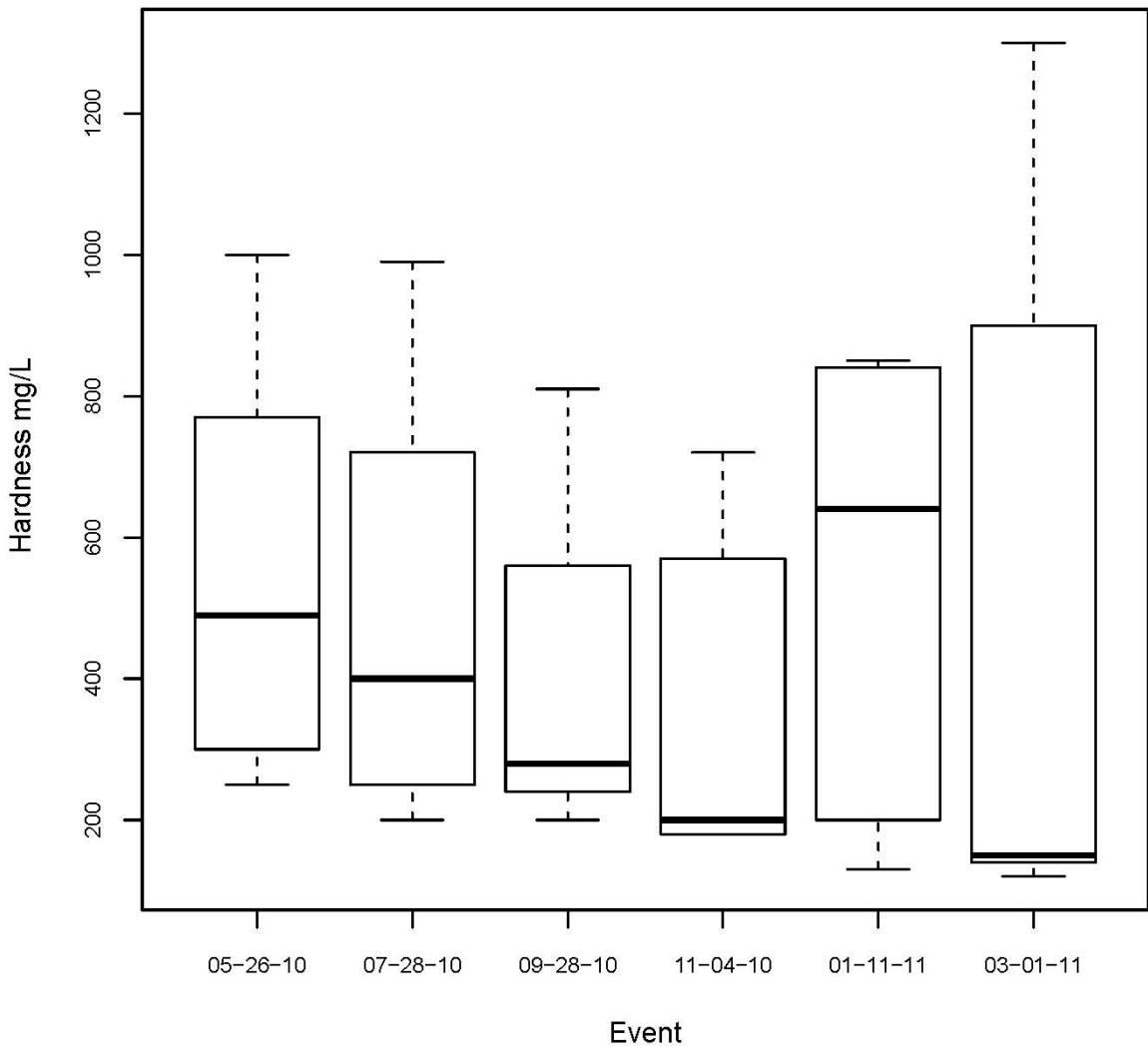
Total Copper across All Sites



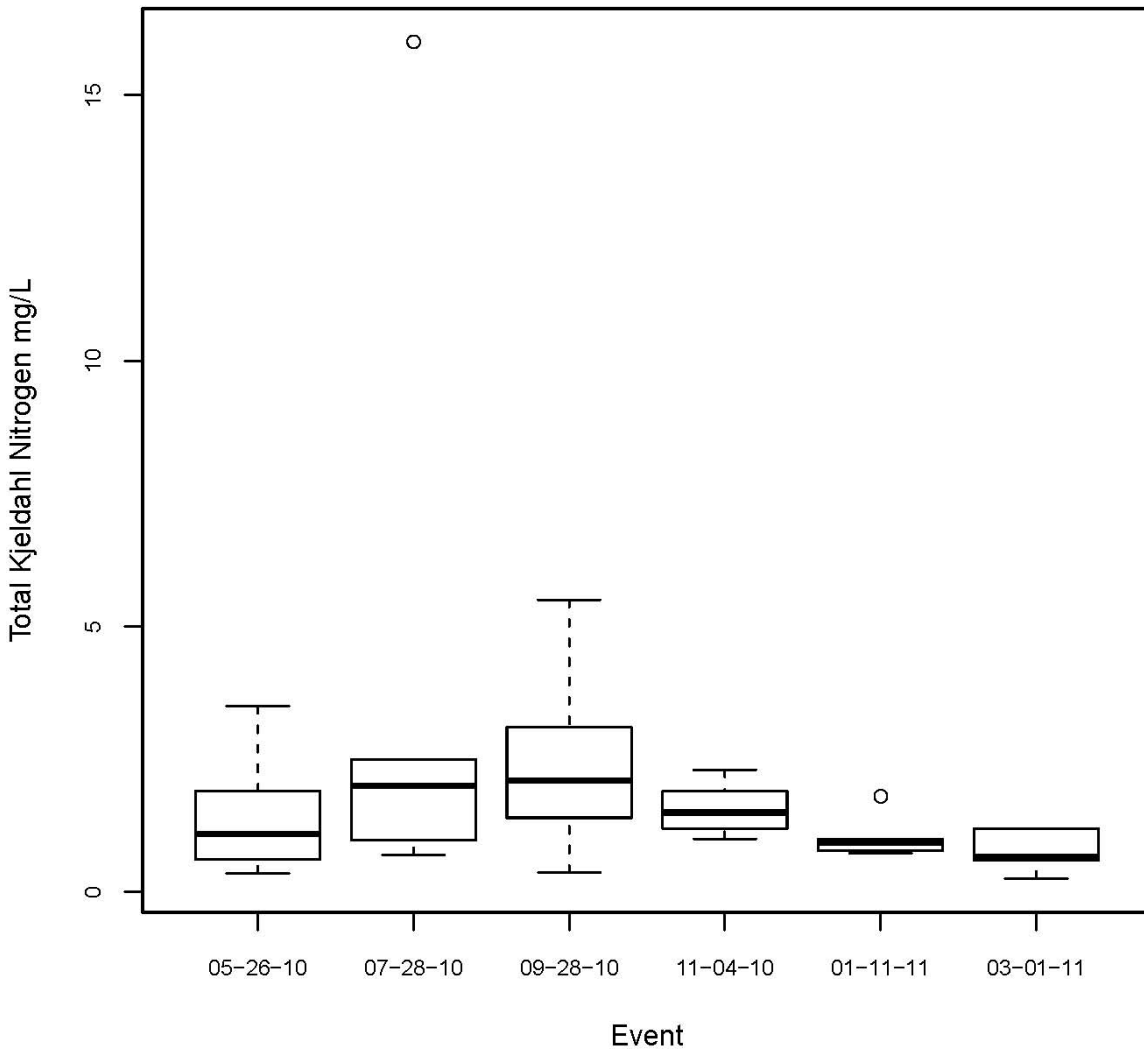
E. coli across All Sites



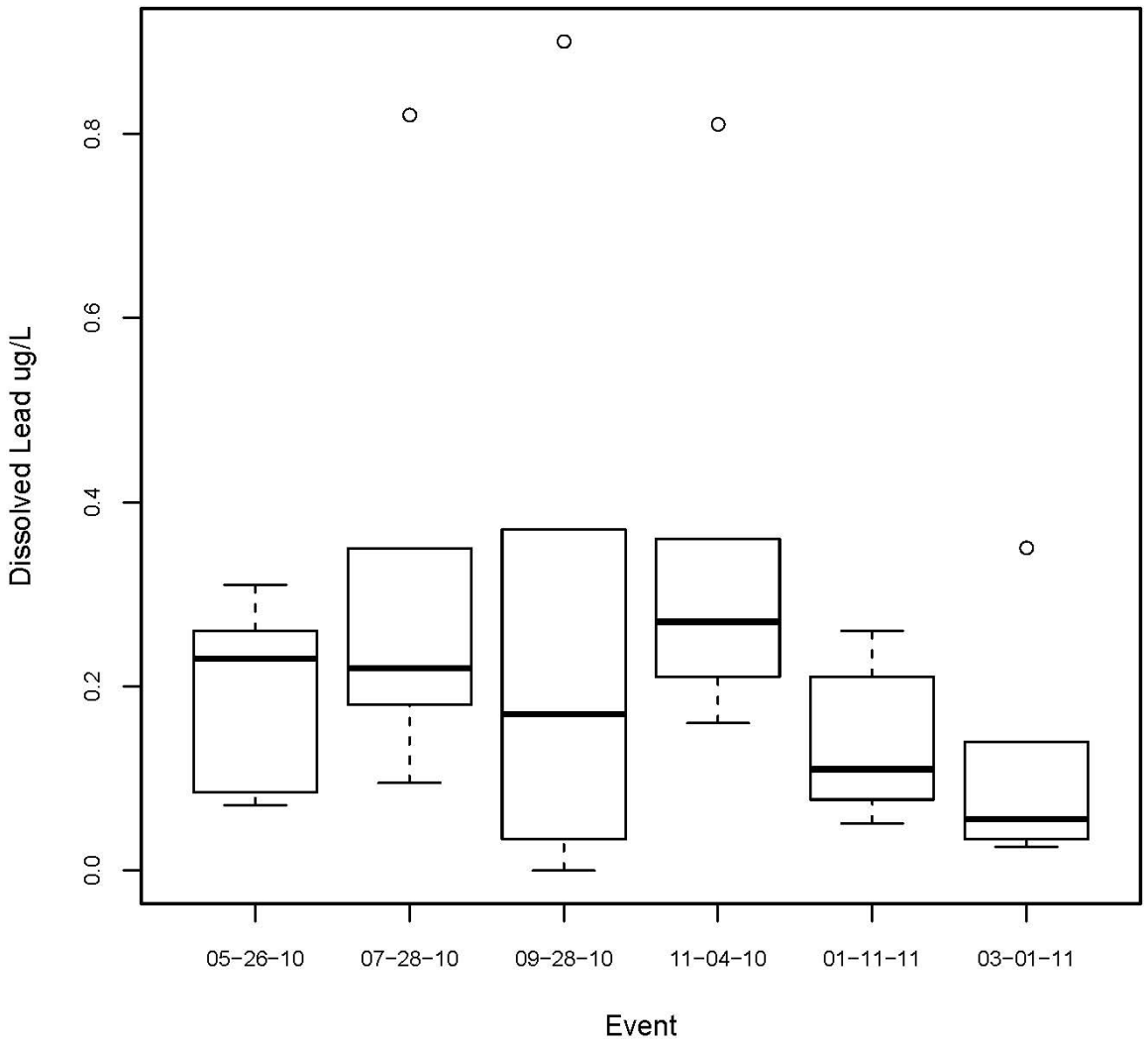
Hardness across All Sites



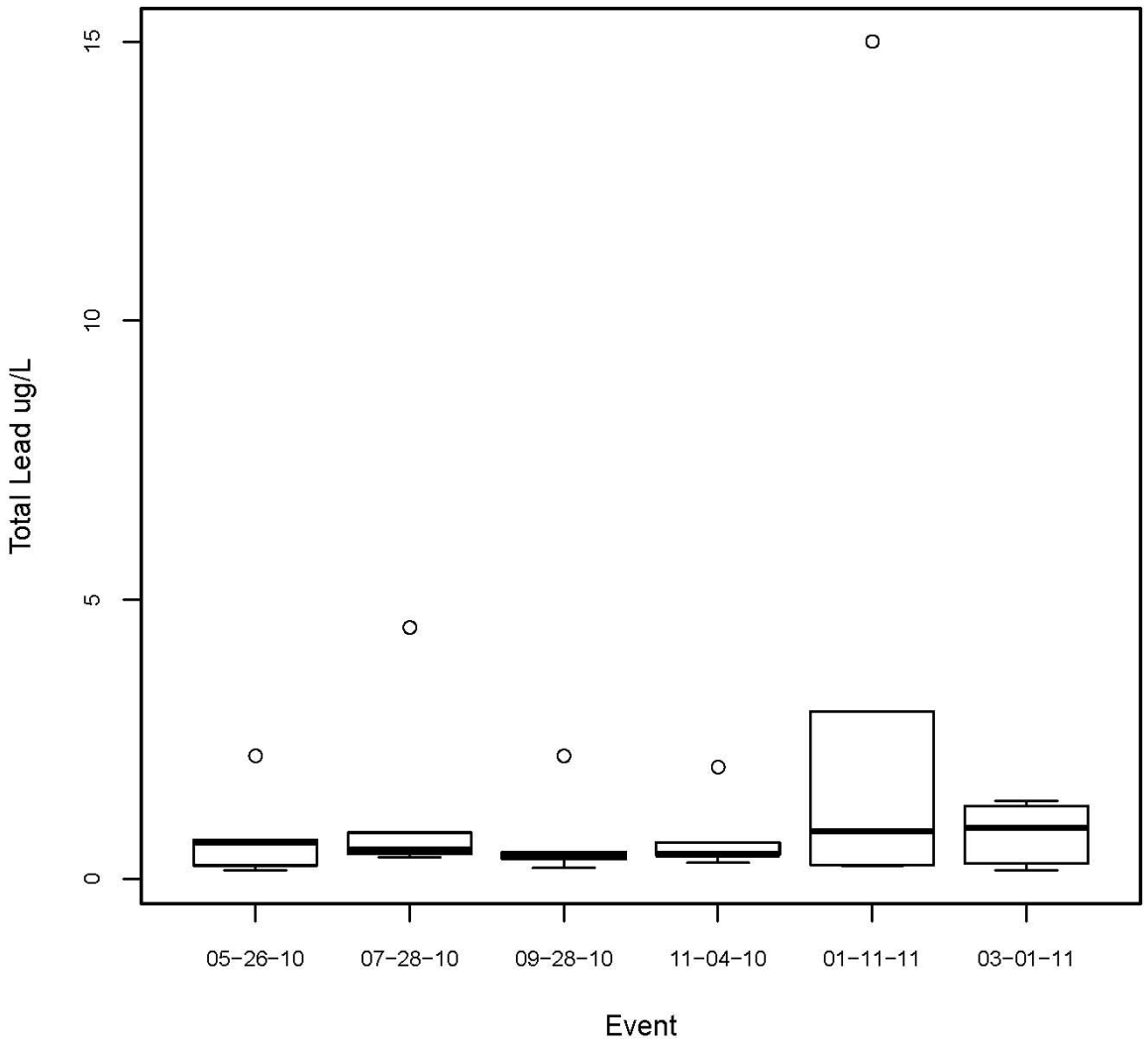
Total Kjeldahl Nitrogen across All Sites



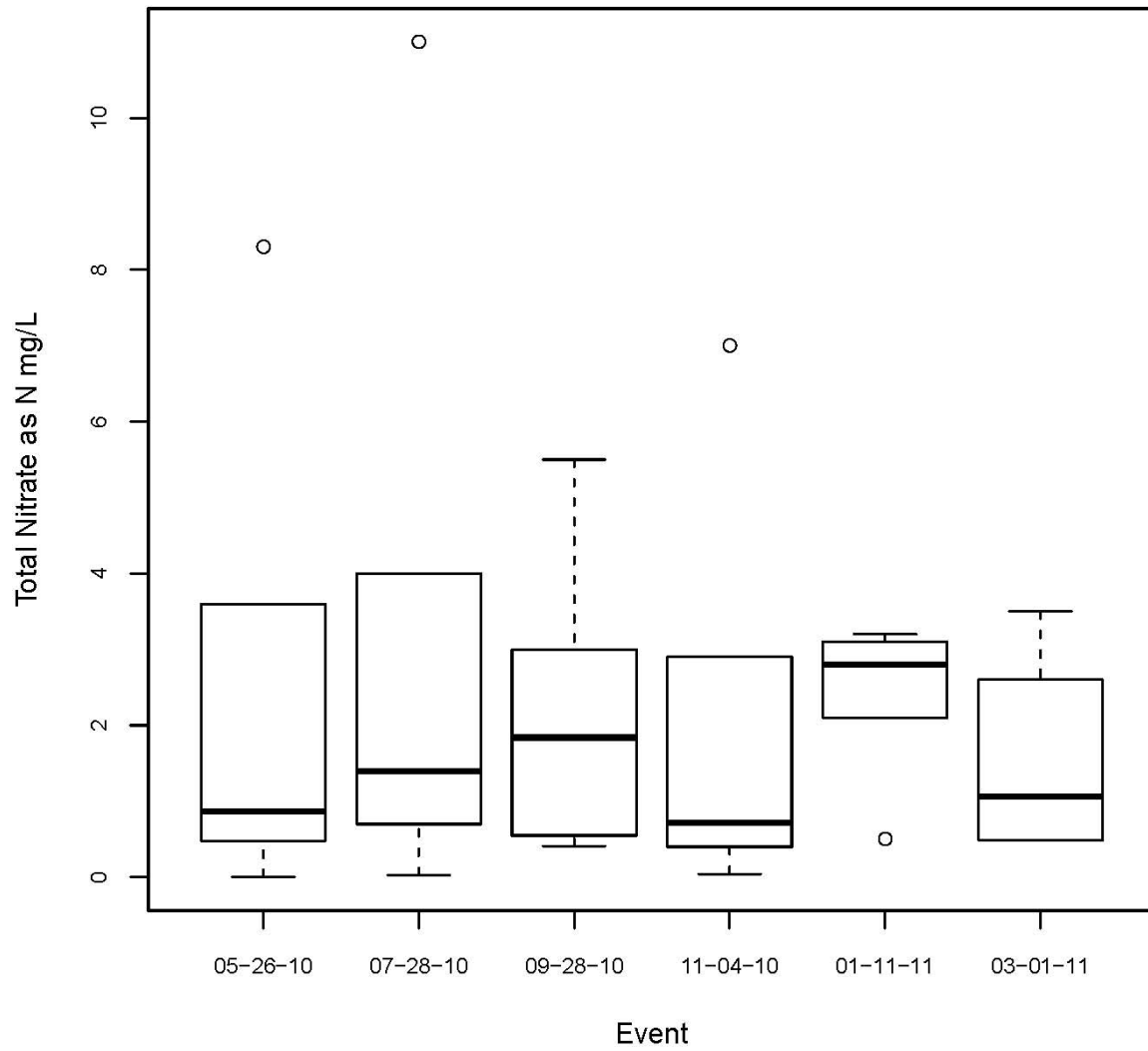
Dissolved Lead across All Sites



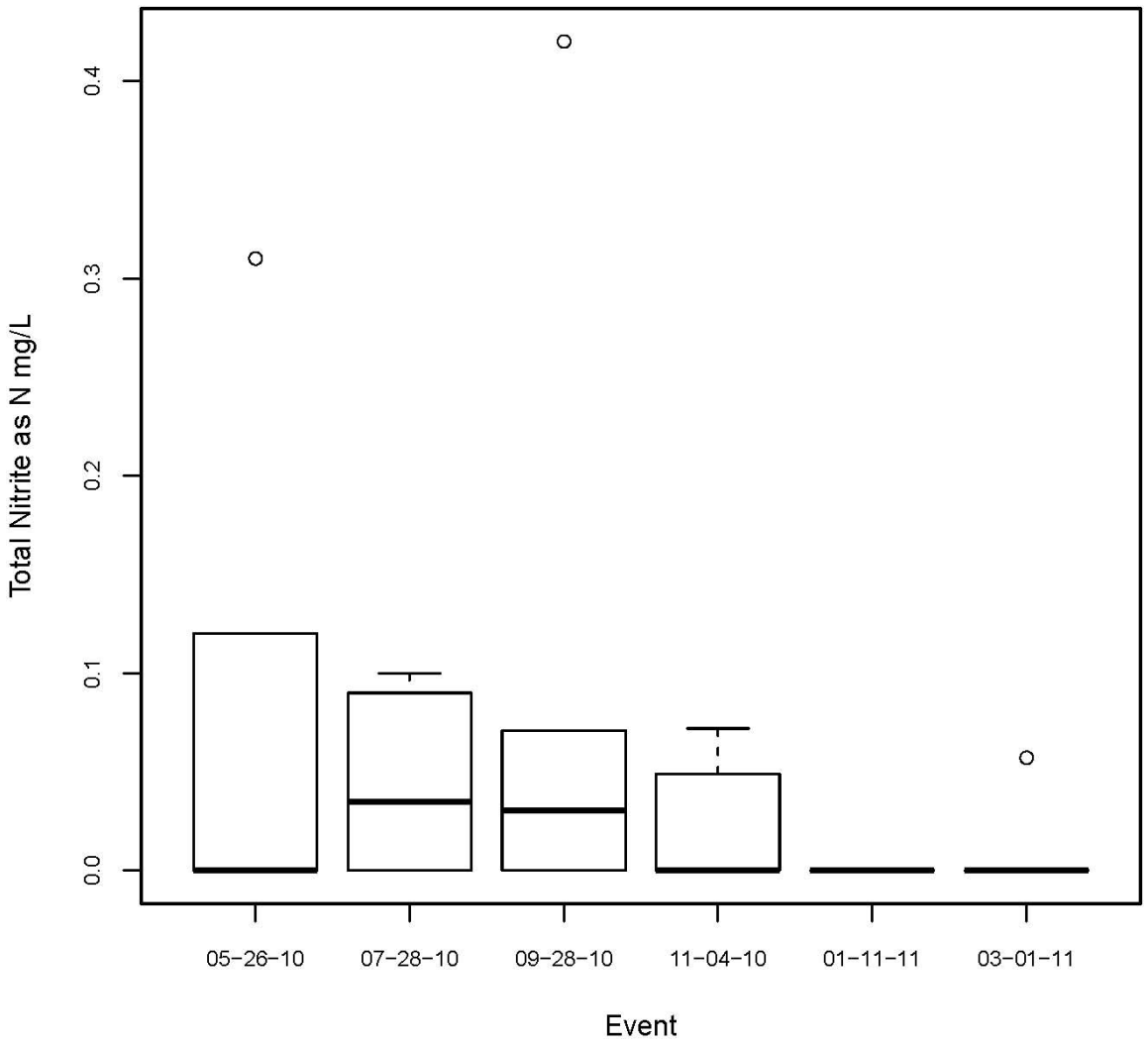
Total Lead across All Sites



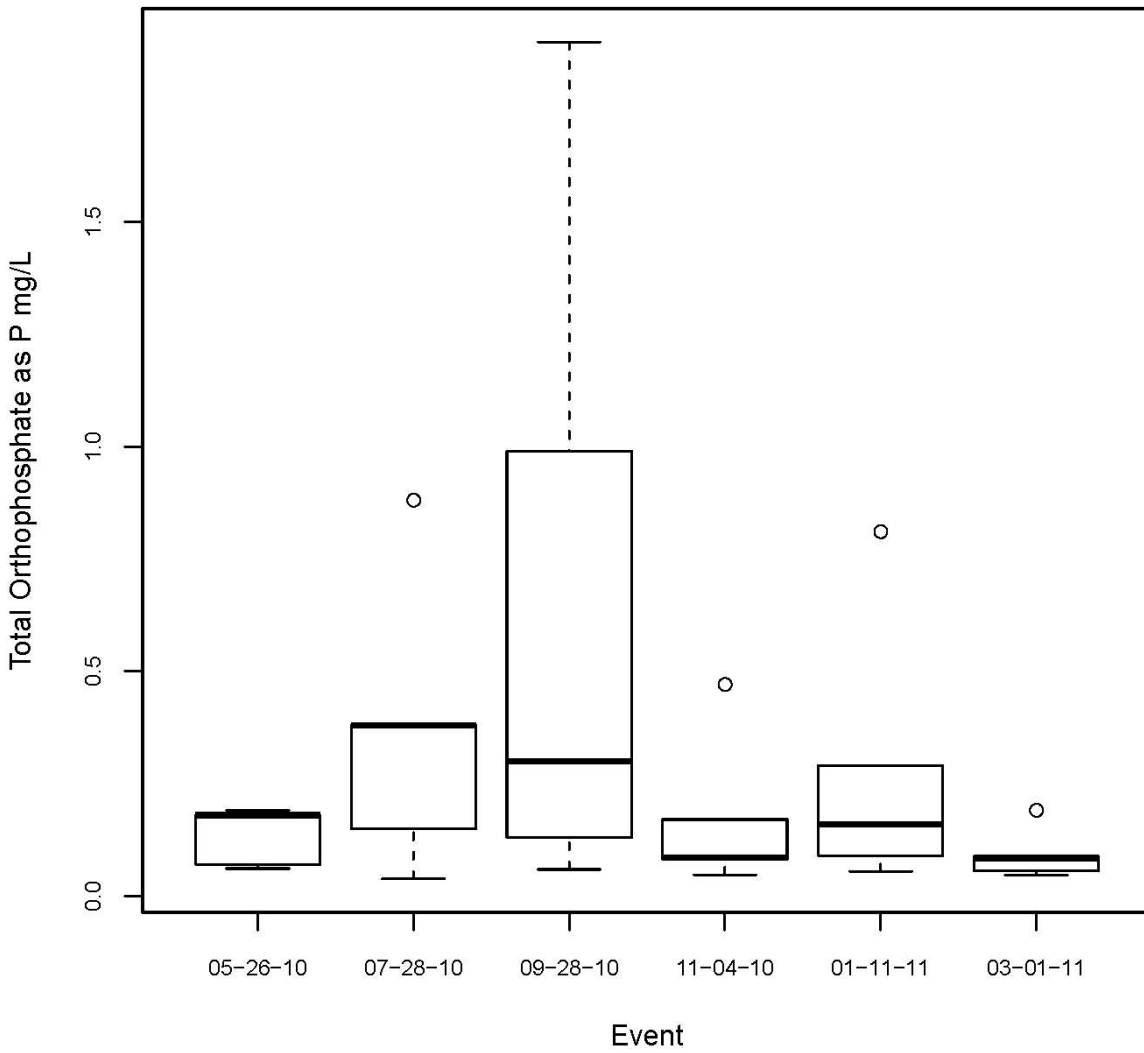
Total Nitrate as N across All Sites



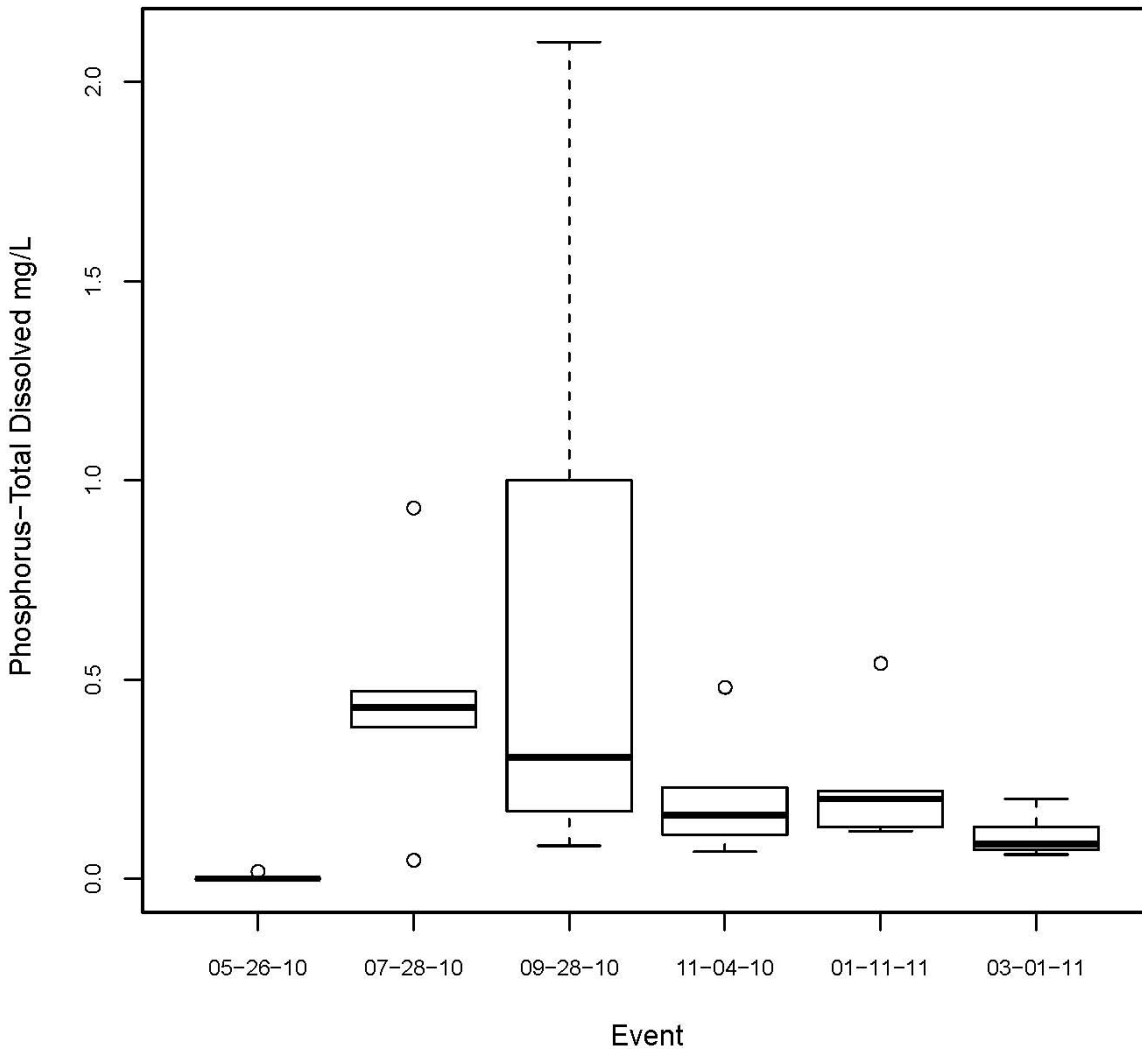
Total Nitrite as N across All Sites



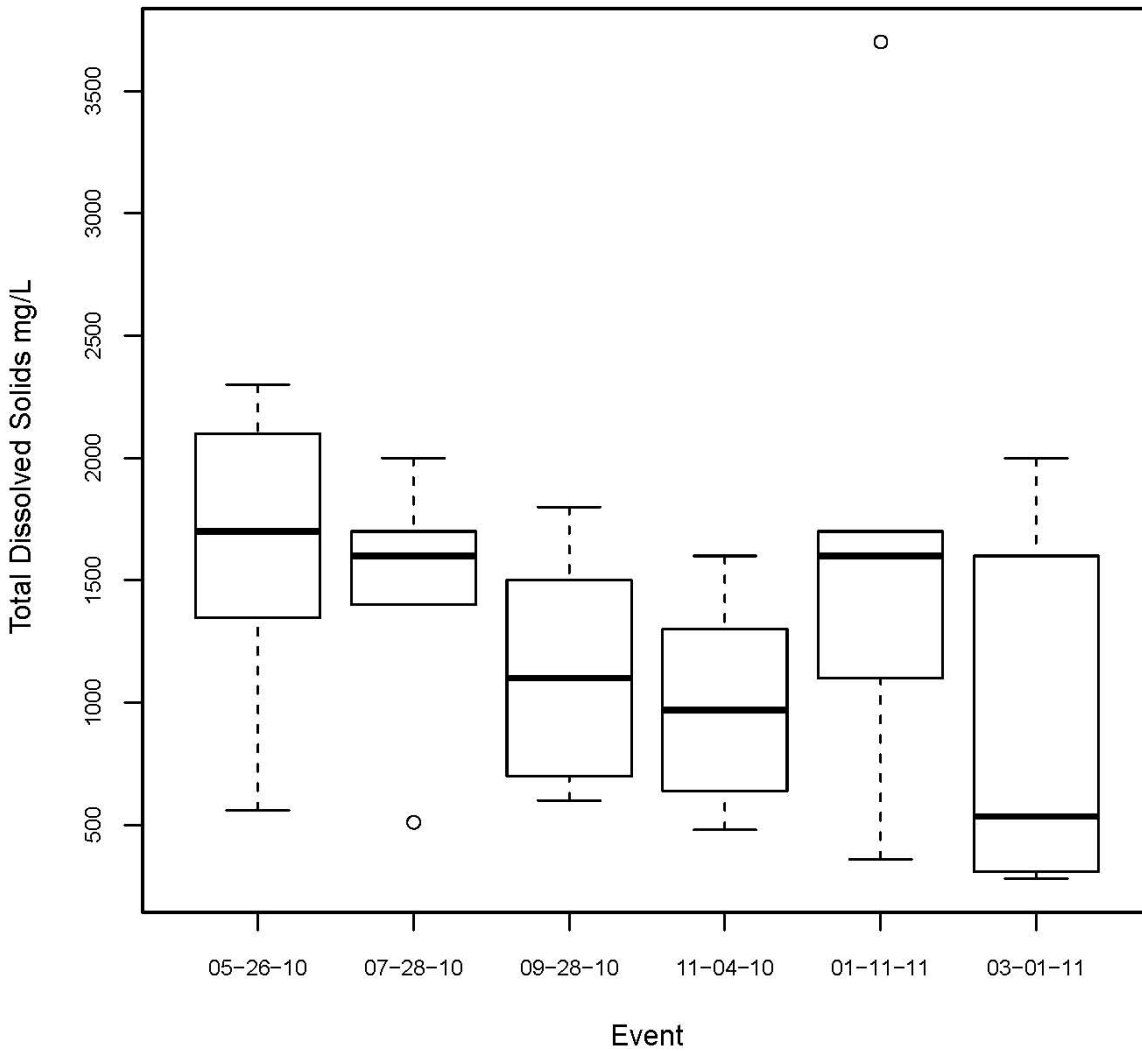
Total Orthophosphate as P across All Sites



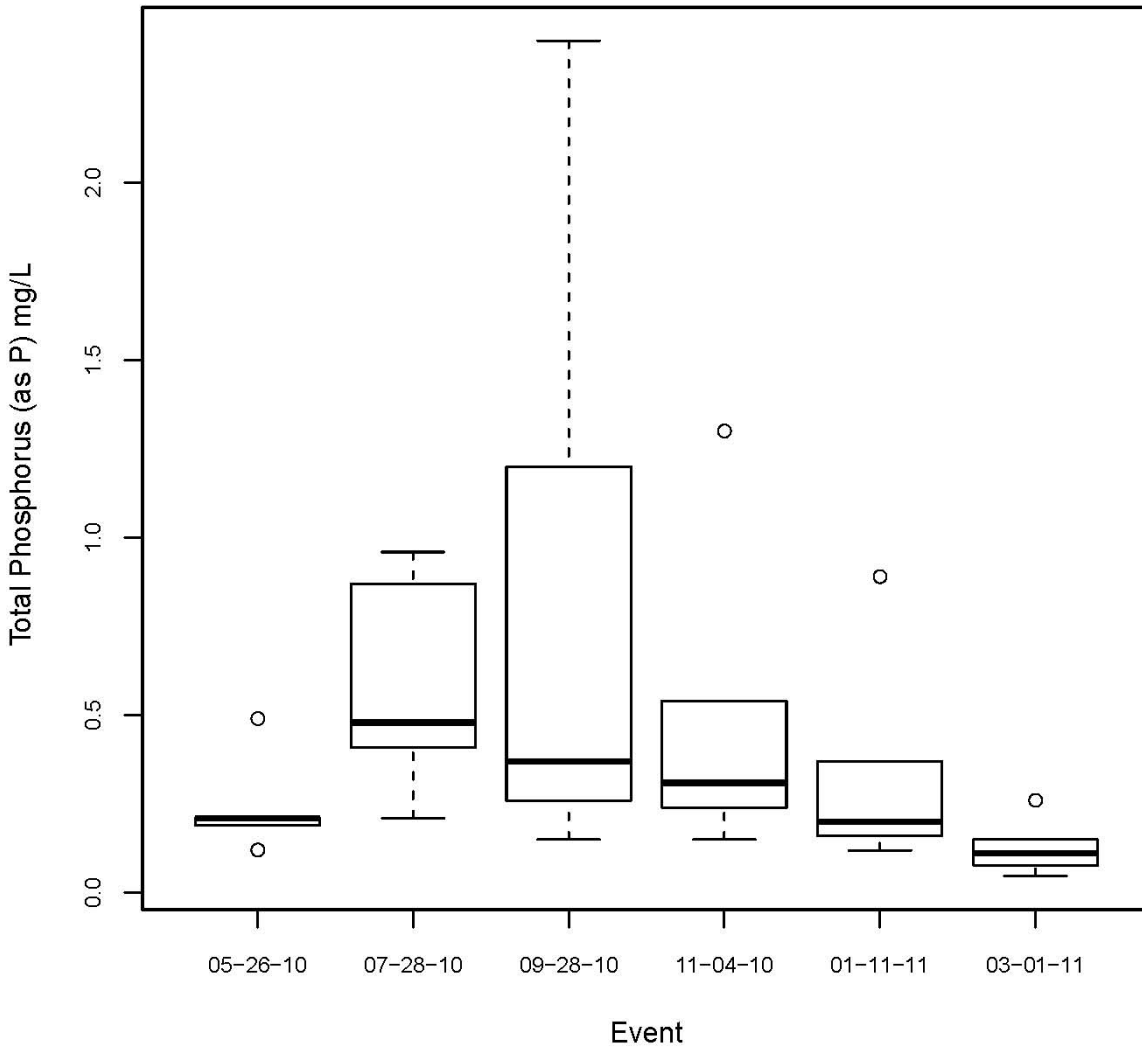
Phosphorus–Total Dissolved across All Sites



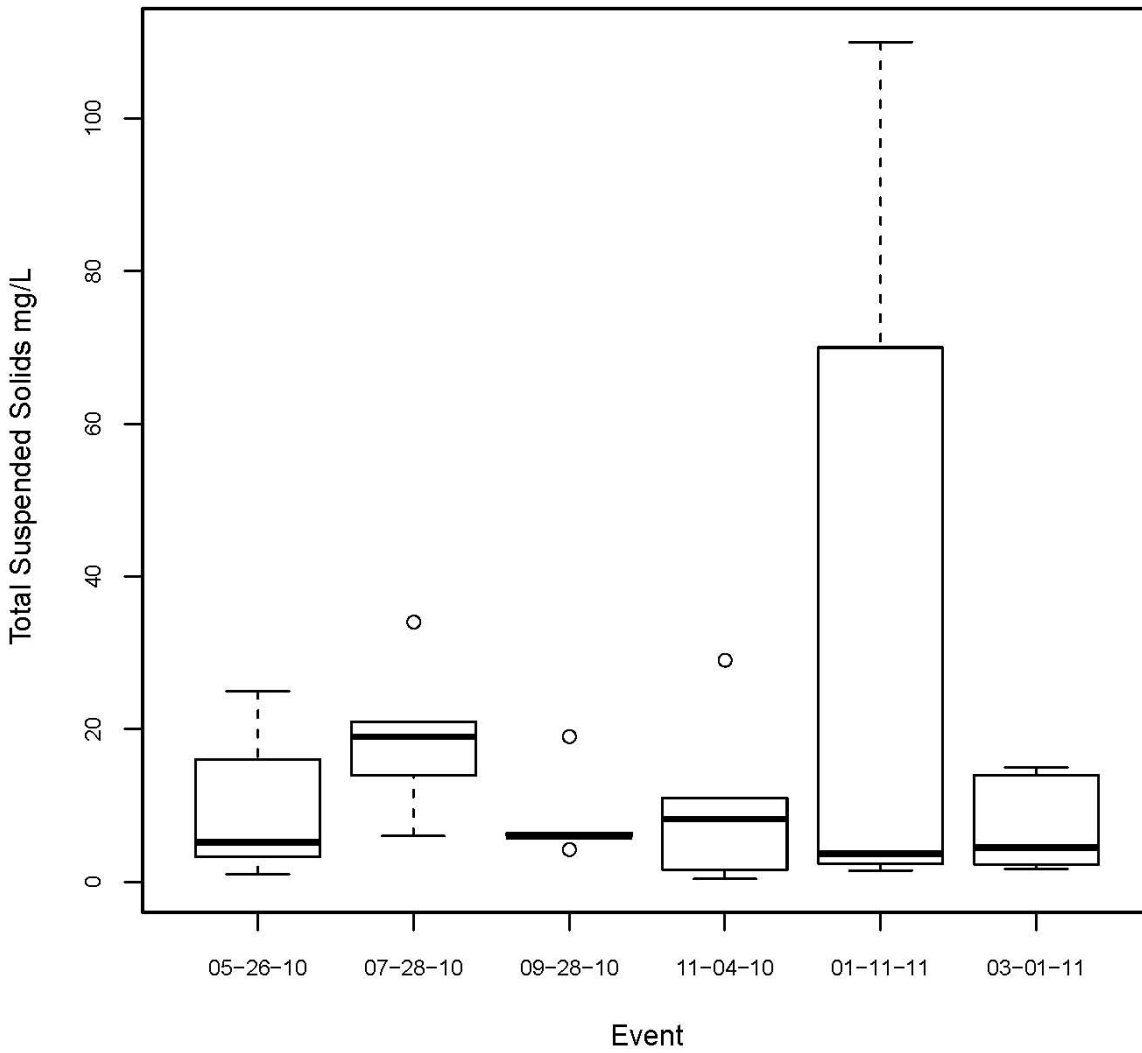
Total Dissolved Solids across All Sites



Total Phosphorus (as P) across All Sites



Total Suspended Solids across All Sites



Appendix C - HOBO Meter Sampling and Analysis

HOBO Meter Data Collection

HOBO meters were installed and launched at each site on July 7, 2010. This occurred as a separate field event, after the completion of Event 1 but before Event 2. Two additional barometric reference HOBO meters were installed and launched at wire fence along the channel access road near 3I_ASHB and the stop sign on Eastvale Road near 1O_EAST, respectively. For the first two months of data collection, the HOBO meters were observed monthly as it was uncertain whether or not the meters would remain operational in the field. Field crews verified that the meters were working and collected the HOBO meter data during Event 2 on July 28, 2010. A field crew again verified the functionality of meters on August 25, 2010 and collected the HOBO meter data. Following these two events, field crews were confident in the HOBO meters' ability to weather the field conditions, and the HOBO meters were collected for data download and were relaunched in conjunction with Events 3 through 6. The HOBO meters are planned to remain in operation for one full year. To this end, most meters will not be removed until July 7, 2011.

For the course of this study, only the HOBO meter data from July 7, 2010 to March 1, 2011 (following sampling event 6) was considered as this remained the fullest extent of analyzed depth data available during the creation of the report.

During Event 3, HOBO meter data for all sites except 3I_ASHB were collected. The failure to collect was the result of a downloading error. During a normal downloading procedure, the HOBO meter is connected to a laptop computer via a USB connection and the data subsequently downloaded. Once complete, the meter is "re-launched" for the device to begin recording data again. Re-launching wipes out all stored data for the data set to refer to only one reference pressure and depth. When the 3I_ASHB HOBO meter was connected to the laptop computer and initiating its data download, an empty data file for 3I_ASHB had been created but appeared to complete its download. At this point, the operator re-launched the HOBO meter, only to discover that the 3I_ASHB file recorded no data. As the meter was re-launched, the data for 3I_ASHB was not recoverable. Field protocol was revised after the incident, ensuring that the field crews verify that the data has completed downloading to the laptop prior to any further action. Data was successfully downloaded to the laptop during all other instances.

HOBO Meter Data Analysis

HOBO loggers continuously record time (T), temperature (T_{ref}), and pressure (P) data every five minutes when placed in the field. Once collected, these data are utilized to calculate the density and depth (D_{Logger}) of the flow.

One can use a barometric data file to compensate for a baseline "depth" measurement that would be generated from ambient air pressure and temperature. The study employs this tactic because flow is frequently shallow or non-existent. The HOBO Barometer calculates its own depth

calculations from its temperature and pressure readings and creates a data set D_{Baro} . During each sampling event, the sampling team records a reference time T and a reference depth $L_{MeasAtTimeT}$. Depth data points from both the HOBO logger ($D_{LoggerAtTimeT}$) and the HOBO barometer ($D_{BaroAtTimeT}$) taken at the same reference time are used for the next equation. If times do not synchronize exactly, the time step closest to the reference time is selected.

A conversion factor k is calculated through the following calculation:

$$k = L_{MeasAtTimeT} - (D_{LoggerAtTimeT} - D_{BaroAtTimeT})$$

This conversion factor is then applied to the data sets as whole, resulting in a new converted data set $D_{calculated}$:

$$D_{calculated} = D_{Logger} - D_{Baro} + k$$

The data set of $D_{calculated}$ for each site was then used for calculation of flow rates.

Occasionally, depth data for the sites 1O_EAST, 1O_ACAD, and 3O_VAND recorded negative values. It was determined that these values were the result of pressure readings at the barometer exceeding the readings at the discharge site, or temperature readings at the discharge site exceeding that of the barometer. These instances were determined to be the likely result of periods of no flow where readings were significantly impacted by ambient temperature and pressure differences. The barometric loggers have been observed to be very sensitive to wind, even when placed within manholes. Pressure and temperature readings are likely to vary significantly when flow over the HOBO logger ceases, surges, or is exposed to sunlight. Such readings were not unexpected. Upon review, negative depths were assigned a value of 0 to indicate that no flow was likely present at the time of reading.

Changes to HOBO Meter Locations

The barometric reference HOBO meter near 3I_ASHB was moved to the area directly below the manhole at 1O_ACAD during Event 4 to improve stability of the readings by establishing a reference site that was more similar to that of the several manhole discharge sites and placing the meter in an area more protected from wind and sunlight.

Appendix D - QA/QC Review of Dry Weather Samples

The QA/QC analysis for all six sampling events indicated the following:

- **Hold Times:** USEPA analytical hold time guidelines place requirements on sample filtration, preservation, and/or analysis. All hold times were met for all events.
- **Blank Contamination:** The use of field blanks and method blanks are intended to test whether contamination is introduced from sample collection and handling, sample processing, analytical procedures, or the sample containers. The field and laboratory method blanks for total and dissolved lead reported concentrations above the detection limit during Event 6. Four of the six dissolved lead samples recorded values within five times the amount of the blanks and were flagged as upper-limit estimations. One of the six total lead samples recorded a value within five times the amount of the blank and was flagged as an upper-limit estimation. With both blanks reporting detectable concentrations, the laboratory environment was determined to be the source of contamination and not the sampling procedure. Given the sensitivity of the instruments used to measure the metals concentrations, detections of trace amounts are not unexpected. All other field and laboratory blanks recorded values that were below the method reporting limits.
- **Precision:** The purpose of analyzing duplicates is to demonstrate precision of sample collection, preparation and analytical methods. Laboratory duplicate samples met applicable requirements defined in the Work Plan across all events. Field duplicate samples for total suspended solids (TSS) exceeded the program Relative Percent Difference (RPD) during Events 1, 2, and 6. The RPD values indicated that the environments were variable for TSS, which was not unexpected. In addition, it was determined that the entirety of the sample bottle was not used in the TSS analysis for Event 6, which was a deviation from standard laboratory practices due to laboratory error. Field duplicate samples for total kjeldahl nitrogen (TKN) exceeded the RPD during Event 2. The RPD value indicated that the environment was variable for TKN. This was not unexpected. Field duplicate samples for orthophosphate exceeded the program RPD during Event 1. The exceedance was between samples of values near the reporting limit, accentuating the measured differences. This indicated that Orthophosphate was variable at low levels. Field duplicate samples for dissolved lead exceeded the program RPD during Events 4 and 6. For Event 4, the RPD exceedance was likely the result of low concentrations as well as natural variability within the environment. For Event 6, it was concluded that the combination of relatively low concentrations, instrument sensitivity, lab environment, and general variability of the water contributed to the exceedances in RPD, which was not unexpected. Field duplicate samples for *E. coli* exceeded the program RPD during Events 1, 2, and 3. The RPD value indicated that the environments were variable for *E. coli*, which was not unexpected. All other samples met applicable standards defined in the Work Plan.
- **Accuracy:** The purpose of analyzing laboratory control samples (or a standard reference material) is to demonstrate the accuracy of the sample preparation and analytical methods. The purpose of analyzing matrix spikes and matrix spike duplicates is to demonstrate the performance of the sample preparation and analytical methods in a particular sample matrix. During Event 2, the recovery for the matrix spike sample for 4,4'-DDD exceeded the percent recovery limit by 1 percent. The single detected 4,4'-DDD sample was flagged as "MS>UL" because it qualified as the upper limit of the

actual value. All other samples for the event and all other events recorded 4,4'-DDD as non-detect. The 2,4'-DDT matrix spike and matrix spike duplicate were both below the control limits due to matrix interference during Event 4. Review determined that the difference was only 5 percent outside control limits and not unexpected, but 2,4'-DDT samples for the event were flagged as "MS<LL" because the low recovery on matrix samples potentially could lead to an underestimation of sample concentrations. All samples for the event and all other events recorded 2,4'-DDT as non-detect. Matrix spike and matrix spike duplicate samples for 4,4'-DDT were outside of the control limits during Event 4 due to matrix interference. The corresponding samples for the event were flagged as estimated. All samples for the event and all other events recorded 4,4'-DDT as non-detect. The RPD for matrix spike and matrix spike duplicate samples' PCB congeners 126 and 206 were outside of the acceptable range during Event 5. The corresponding samples for the event were flagged as estimated. All samples of the PCB congeners for the event and all other events were recorded as non-detect. All other laboratory duplicates and matrix recoveries met the applicable standards defined in the Work Plan.

No trends in QA/QC qualifications were identified between events.

Appendix E-1 - Calculation of Sample Site Flow Rates

For the HOBO meter data to be effectively used as an estimation of flow rates over the course of the study, the depth readings first needed to be confirmed as reliable estimations of depth and then those depth readings needed to be converted into reliable estimations of flow.

Initial observations indicated that HOBO meter depth readings were not replicating the depth measurements taken at each site during sampling events. For instance, during Event 2, the average measurement of depth taken by the field team was 0.68 inches, yet the HOBO meter had recorded a depth of 0.083 feet, or 1 inch, of flow immediately prior to its extraction. For the HOBO readings to be more representative of the depth measurements, the readings would need to be transformed by a linear factor. The average of the previous 4 sampled depths prior to extraction (representing 20 minutes) at Events 2 through 6 (the events for which HOBO meter data was available), was regressed against the average of all depth measurements taken at the respective sampling event. These measurements observed low variance, ensuring that each average presented an accurate representation of typical HOBO meter reading and flow depth. Regressions were fit to a linear equation with an intercept of 0 to ensure that a measured depth reading of zero would correspond to a HOBO meter depth of zero. The regressions indicated that for most sites, HOBO readings typically overestimated the depth.

A regression was not taken for 1O_EAST because only 1 non-zero data point was available for actual measured depth. Review of the non-zero data for 1O_EAST suggested that HOBO meter depth readings corresponded well to actual measurements of depth, and thus no transformation of the depth data was performed. The HOBO data set for 1O_EAST was converted directly from feet to inches (i.e. multiplied by 12) for the second phase of conversion from depth in inches to flow in cubic feet per second to be performed.

Figure E-1-1 through **Figure E-1-5** present the linear regressions between HOBO meter depth readings and depth measurements for each site.

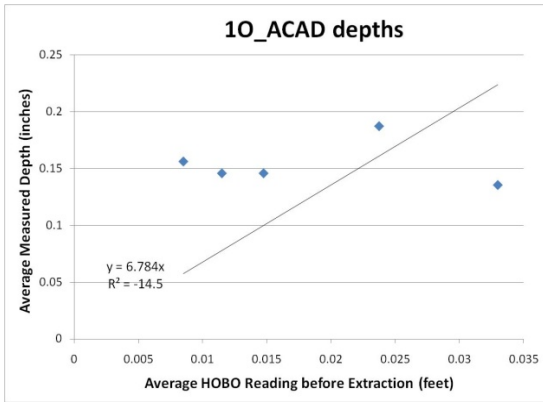


Figure E-1-1 - HOB0 Depth Readings vs. Measured Depths at 10_ACAD

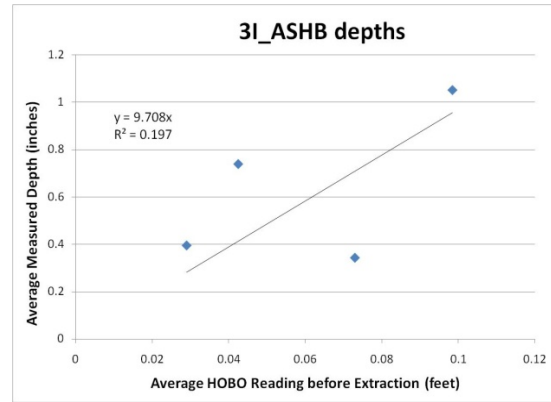


Figure E-1-2 - HOB0 Depth Readings vs. Measured Depths at 3I_ASHB

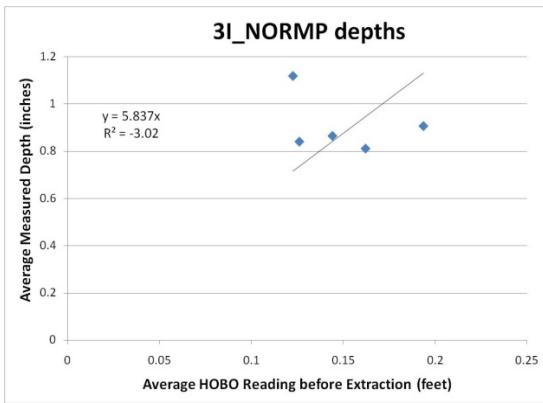


Figure E-1-3 - HOB0 Depth Readings vs. Measured Depths at 3I_NORMP

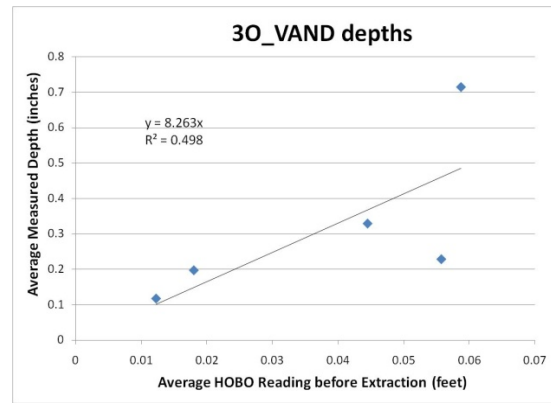


Figure E-1-4 - HOB0 Depth Readings vs. Measured Depths at 3O_VAND

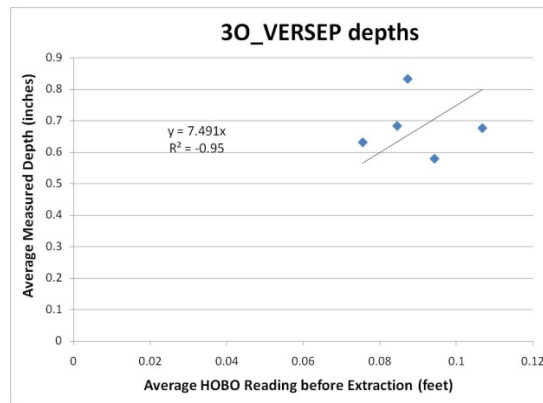


Figure E-1-5 - HOB0 Depth Readings vs. Measured Depths at 3O_VERSEP

Depth measurements were converted to flow based upon the flow calculations recorded during each sampling event. Sampling event flow was calculated by measuring flow depth, width, and surface velocity at several locations. These measurements then took into account whether each site was an open channel or a pipe to calculate a flow rate. To apply a solitary depth

measurement from the HOBO meter to a reading of flow, it was decided that a correlation between a single measured depth - the average of all measured depths per site - and the calculated flow rate be established. The average measured depth for Event 2 through Event 6 was regressed against the calculated flow rate for the associated site and event. Regressions were chosen as either linear or a power function based upon optimal fit as well as the characteristics of the site (i.e. a pipe, culvert, or open channel). All regressions were assigned a y intercept of 0 for instances of zero depth to correspond with no flow, which had been determined to be accurate during initial review of the HOBO meter data.

Despite having only 1 non-zero data point, a regression for 1O_EAST was performed as there was no other available data from which to estimate flow rates at 1O_EAST.

Figure E-1-6 through **Figure E-1-11** present the regressions between average depth measurements and flow rates for each site.

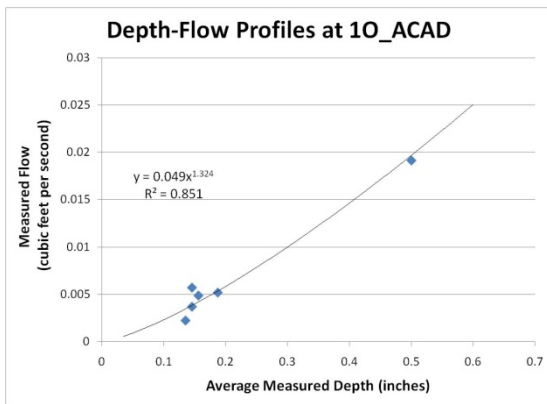


Figure E-1-6 - Measured Depth Readings vs. Measured Flows at 1O_ACAD

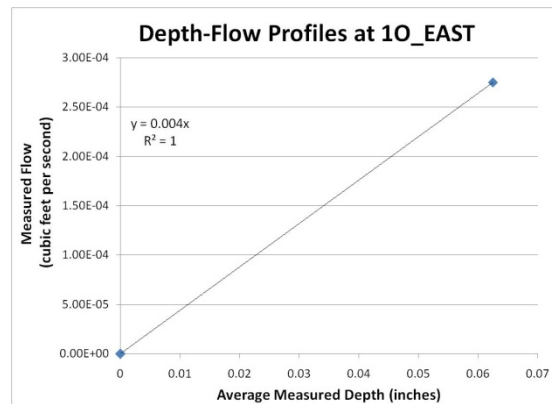


Figure E-1-7 - Measured Depth Readings vs. Measured Flows at 1O_EAST

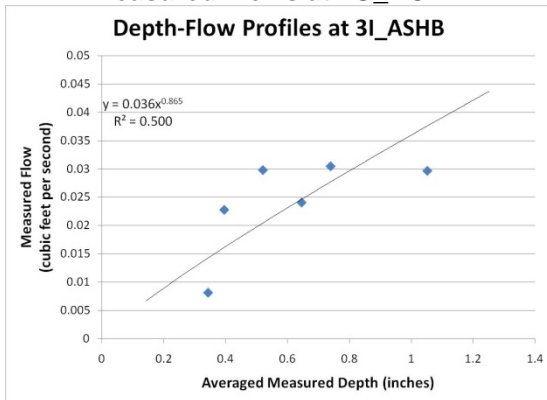


Figure E-1-8 - Measured Depth Readings vs. Measured Flows at 3I_ASHB

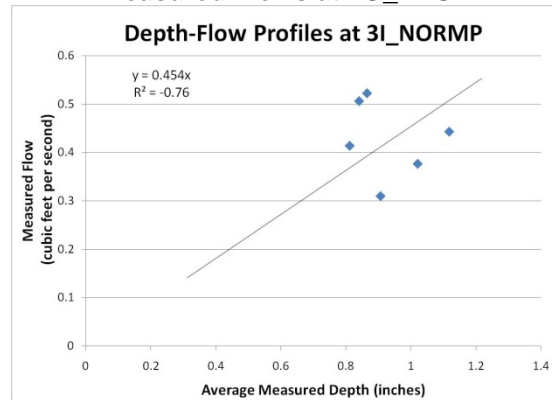


Figure E-1-9 - Measured Depth Readings vs. Measured Flows at 3I_NORMP

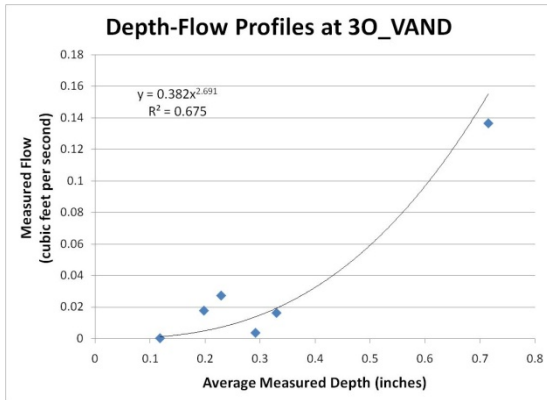


Figure E-10 - Measured Depth Readings vs. Measured Flows at 30_VAND

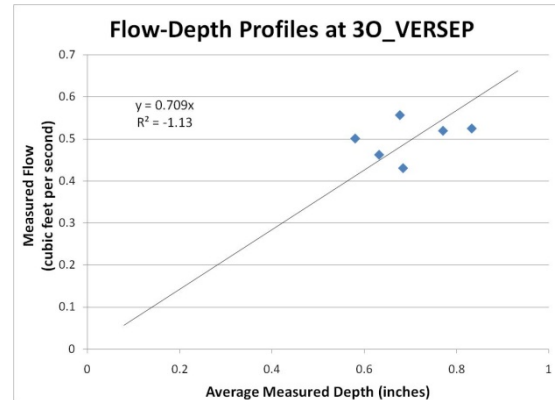


Figure E-11 - Measured Depth Readings vs. Measured Flows at 30_VERSEP

With two equations established between HOBO meter readings, depth measurements, and flow measurements, respectively, a conversion of HOBO meter readings to flow estimations could be developed. **Table E-1-1** presents each site's regression equations used for each step in the conversion, as well as the data points associated with the regressions.

Table E-1-1 - Regressions for Hobo-read Depth, Measured Depth, and Flow Rate

	Average Depth before HOBO Extraction (feet)	Best Fit Regression Equation	Average Measured Depth (inches)	Best Fit Regression Equation	Measured Flows (cubic feet per second)
10_ACAD					
Event 2	0.0330	$y = 6.784 x$	0.1354	$y = 0.049 x^{1.324}$	0.0022
Event 3	0.0085		0.1563		0.0049
Event 4	0.0115		0.1458		0.0057
Event 5	0.0148		0.1458		0.0037
Event 6	0.0238		0.1875		0.0052
10_EAST					
Event 2	0.0065	No regression $y = 12.00 x$	0.0000	$y = 0.004x$	0.0000
Event 3	0.0255		0.0000		0.0000
Event 4	0.0000		0.0000		0.0000
Event 5	0.0020		0.0000		0.0000
Event 6	0.0033		0.0625		0.0003
3I_ASHB					
Event 2	0.0985	$y = 9.708 x$	1.0521	$y = 0.036 x^{0.865}$	0.0297
Event 3	NA ¹		0.5208		0.0298
Event 4	0.0730		0.3438		0.0082
Event 5	0.0425		0.7396		0.0305
Event 6	0.0290		0.3958		0.0228
3I_NORMP					
Event 2	0.1623	$y = 5.738 x$	0.8111	$y = 0.454 x$	0.4137
Event 3	0.1938		0.9063		0.3098
Event 4	0.1443		0.8646		0.5222
Event 5	0.1263		0.8403		0.5060

	Average Depth before HOBO Extraction (feet)	Best Fit Regression Equation	Average Measured Depth (inches)	Best Fit Regression Equation	Measured Flows (cubic feet per second)
Event 6	0.1228		1.1181		0.4428
3O_VAND					
Event 2	0.0558	$y = 8.263 x$	0.2292	$y = 0.382 x^{2.691}$	0.0275
Event 3	0.0445		0.3299		0.0164
Event 4	0.0180		0.1979		0.0179
Event 5	0.0123		0.1181		0.0004
Event 6	0.0588		0.7153		0.1367
3O_VERSEP					
Event 2	0.0845	$y = 7.491 x$	0.6840	$y = 0.709 x$	0.4313
Event 3	0.0873		0.8333		0.5255
Event 4	0.0755		0.6319		0.4630
Event 5	0.0943		0.5799		0.5017
Event 6	0.1068		0.6771		0.5573

1 No HOBO Data was downloaded during Event 3 at 3I_ASHB

Overall, the equations for estimated flow through each sampling site are as follows:

Equation E-1-1 - Conversions of HOBO-read Depth to Flow

$$F_{1O_ACAD} = 0.049 x (6.784 x H_{1O_ACAD})^{1.324}$$

$$F_{1O_EAST} = 0.004 x (12 x H_{1O_EAST})$$

$$F_{3I_ASHB} = 0.036 x (9.708 x H_{3I_ASHB})^{0.865}$$

$$F_{3I_NORMP} = 0.454 x (5.738 x H_{3I_NORMP})$$

$$F_{3O_VAND} = 0.382 x (8.263 x H_{3O_VAND})^{2.691}$$

$$F_{3O_VERSEP} = 0.709 x (7.491 x H_{3O_VERSEP})$$

Where:

F = Flow in cubic feet per second, and

H = HOBO depth reading in feet

The entire HOBO meter data set for each site was then converted using **Equation E-1-1**. The time series of flow graphs for each site is presented below in Appendix E-2. It was determined that flow calculations for 3O_VAND significantly overestimate flows during wet weather events. This was not a concern as calculations were intended to be accurate for dry weather flows only.

Considerations

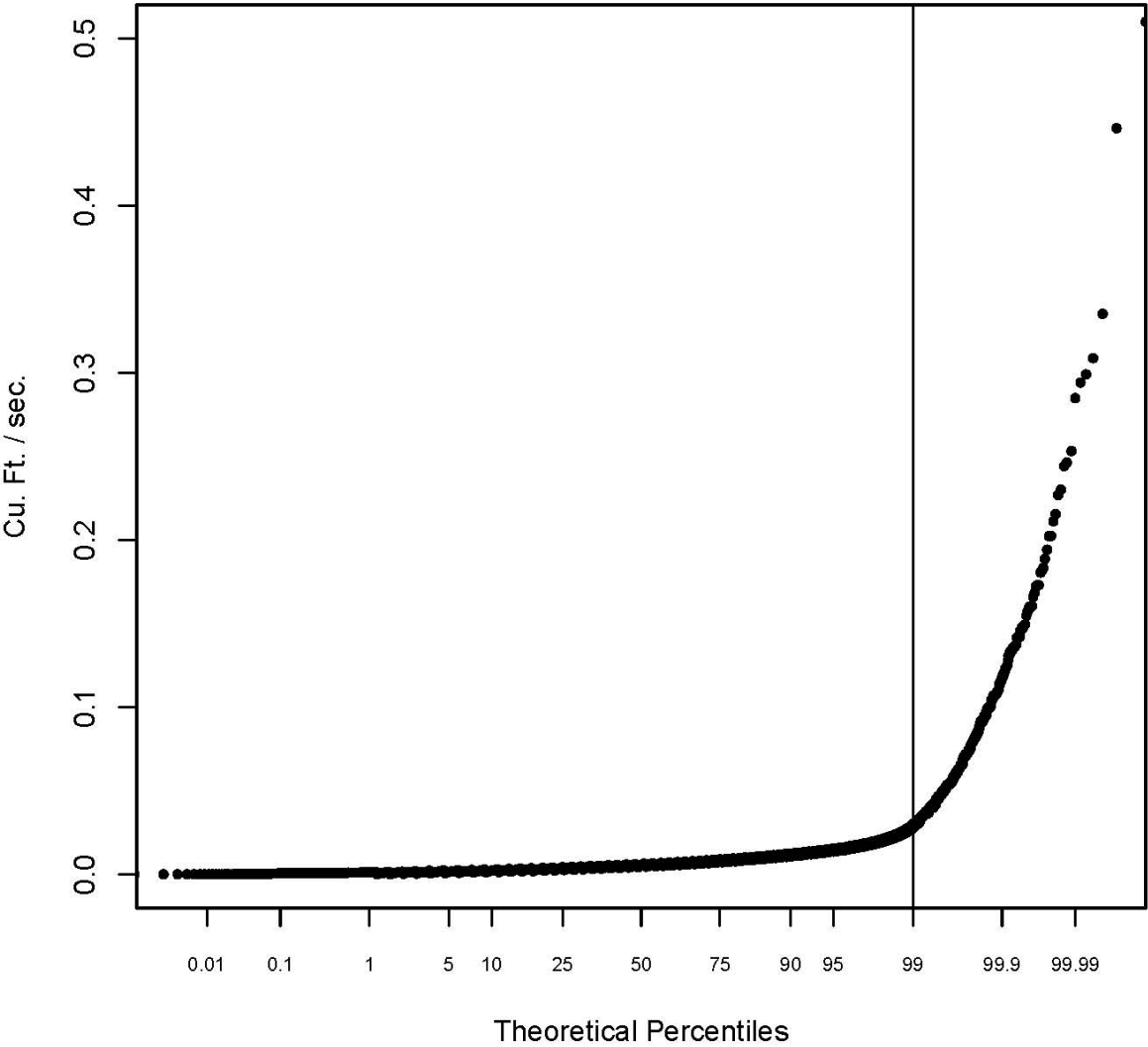
Sample results indicated that dry weather flow at 1O_ACAD, 1O_EAST, and 3O_VAND had high variance, often with one sample deviating from more typical rates of dry weather flow

through the sample location. Nevertheless, it is important to recognize the highly variable nature of urban runoff and that these elevated flow rates do contribute towards dry weather loading to Machado Lake. There was not overwhelming evidence for removal of any data points within each data set, thus all available information was included in the analysis.

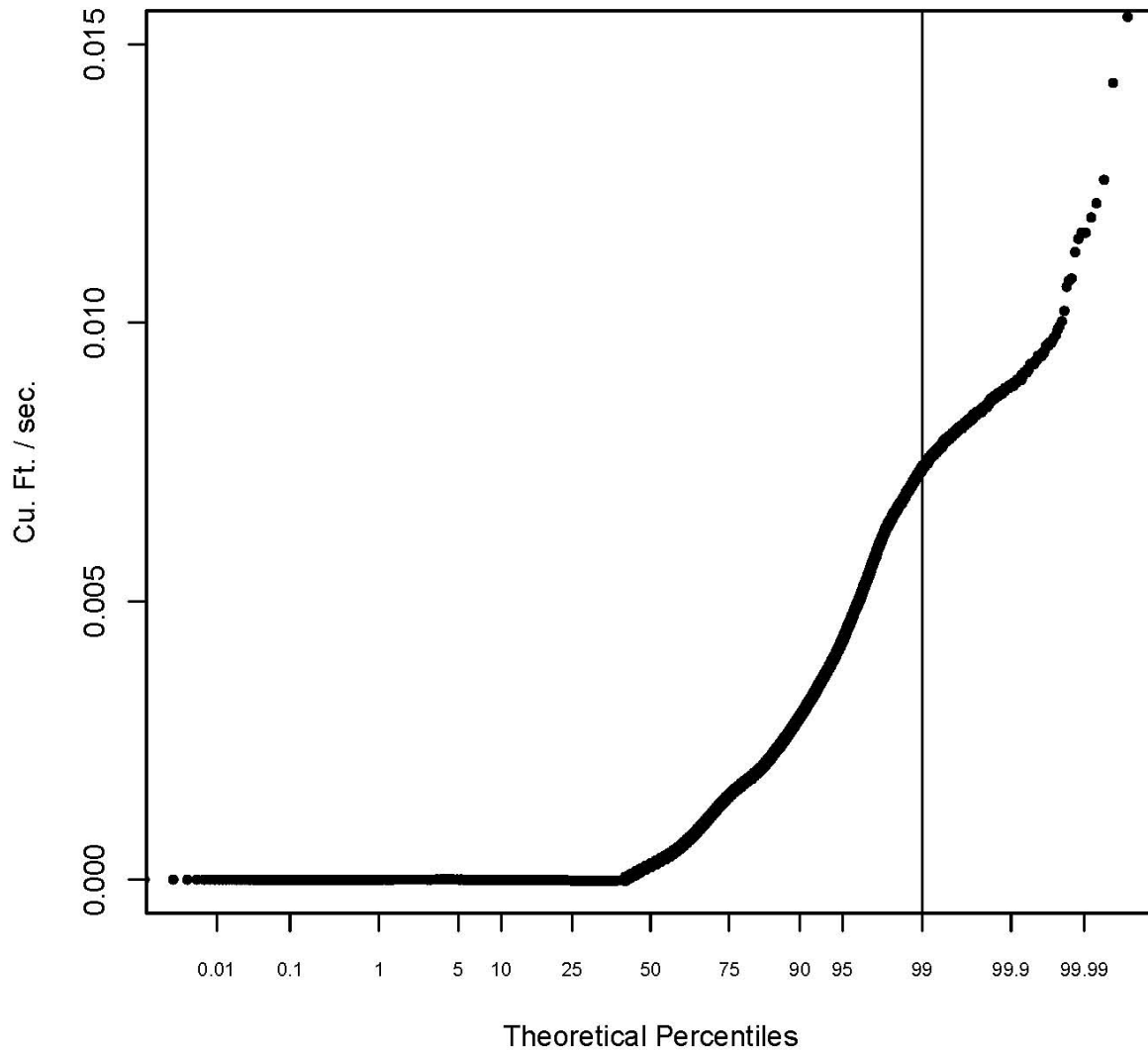
Regressions based upon small sample sizes are not ideal. As such, there is a high degree of uncertainty in most relationships utilized in the depth to flow conversion. For future work, it is recommended that flow and depth measurements performed by the sampling team continue to generate sufficient data for a more confident relationship between continuously-recorded depth records and flow.

Appendix E-2 - Q-Q Plots of Sample Site Flow Rates

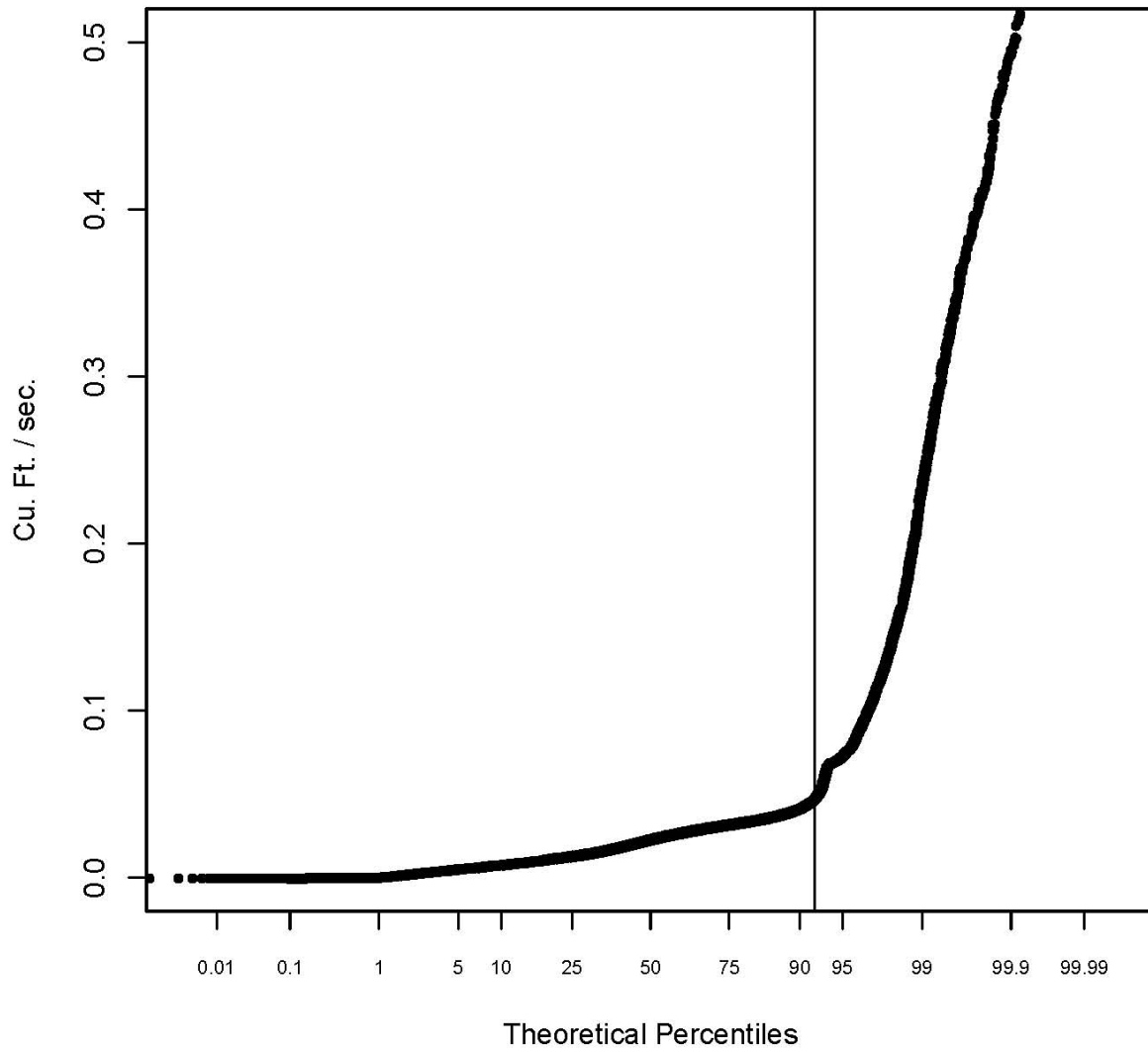
Q-Q Plot for 1O_ACAD Flows



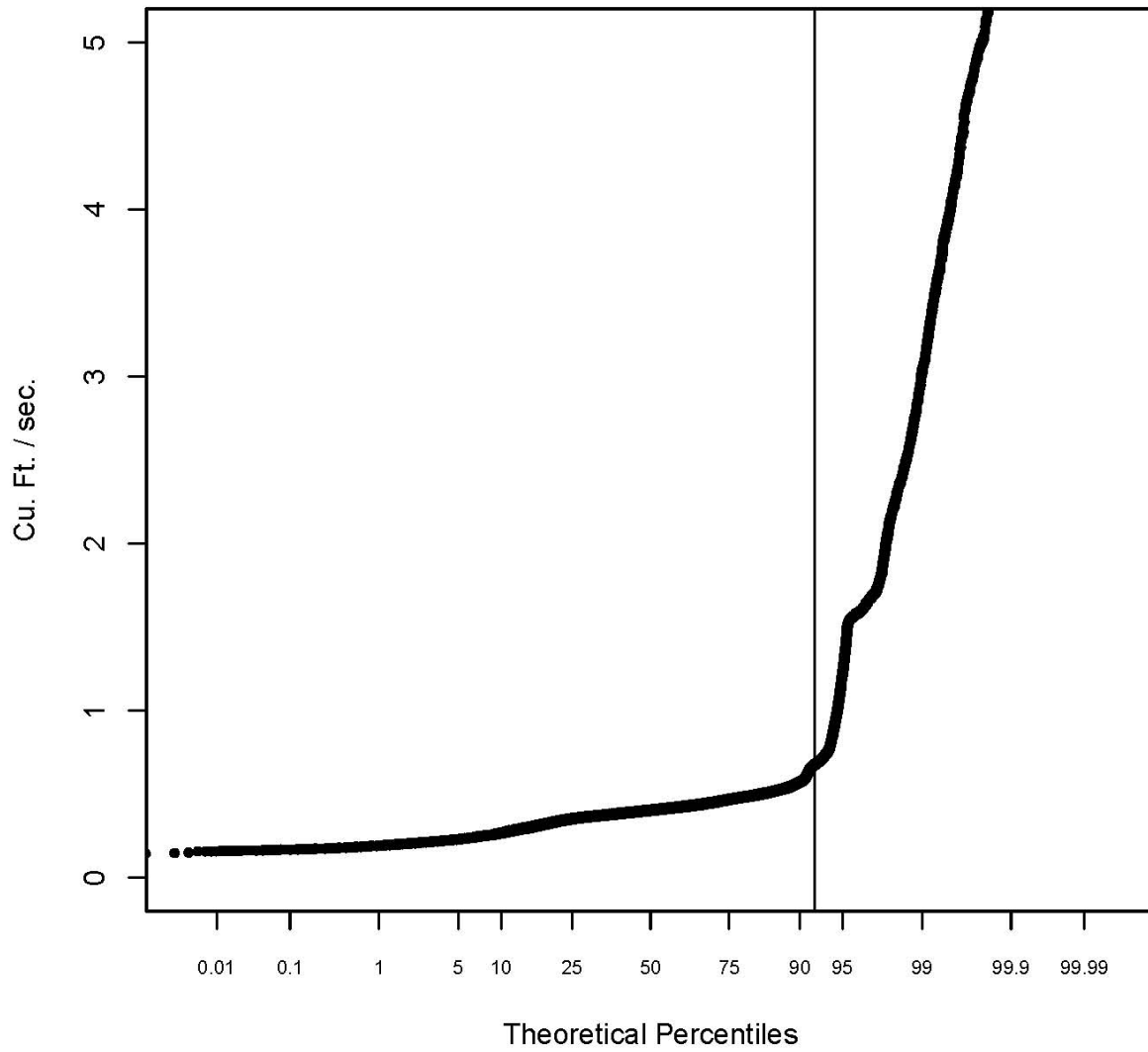
Q-Q Plot for 10_EAST Flows



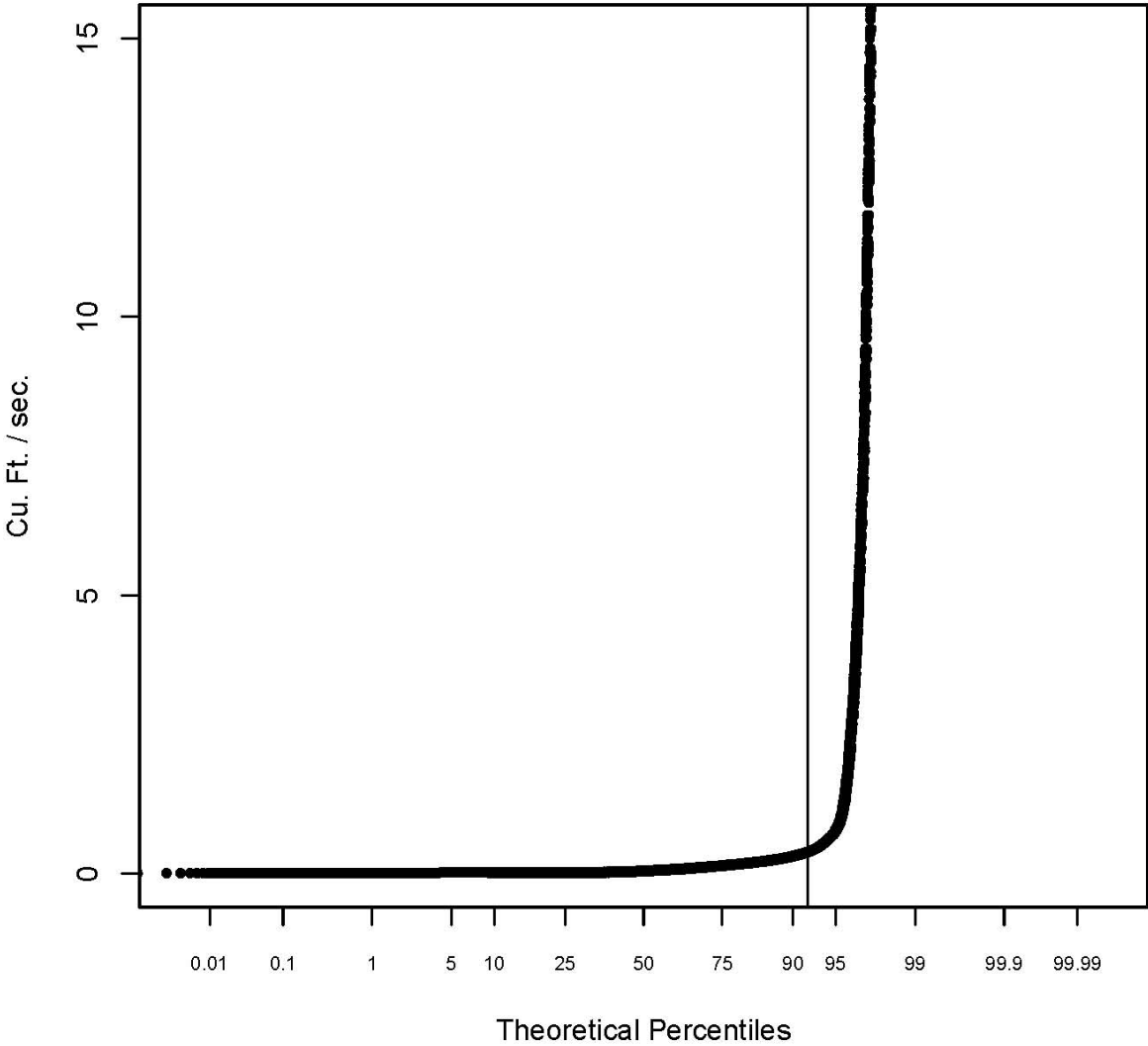
Q-Q Plot for 3I_ASHB Flows



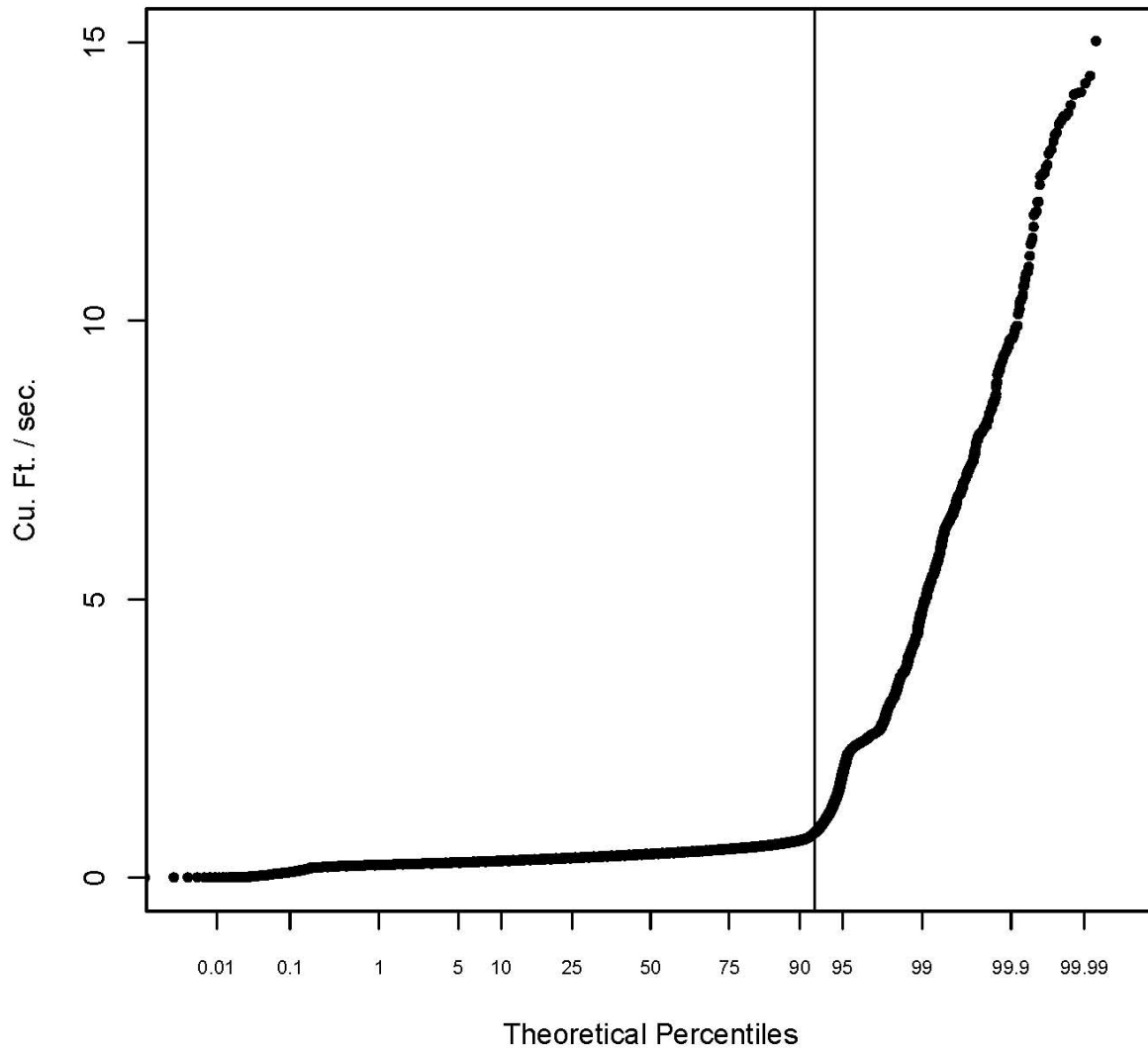
Q-Q Plot for 3I_NORMP Flows



Q-Q Plot for 30_VAND Flows

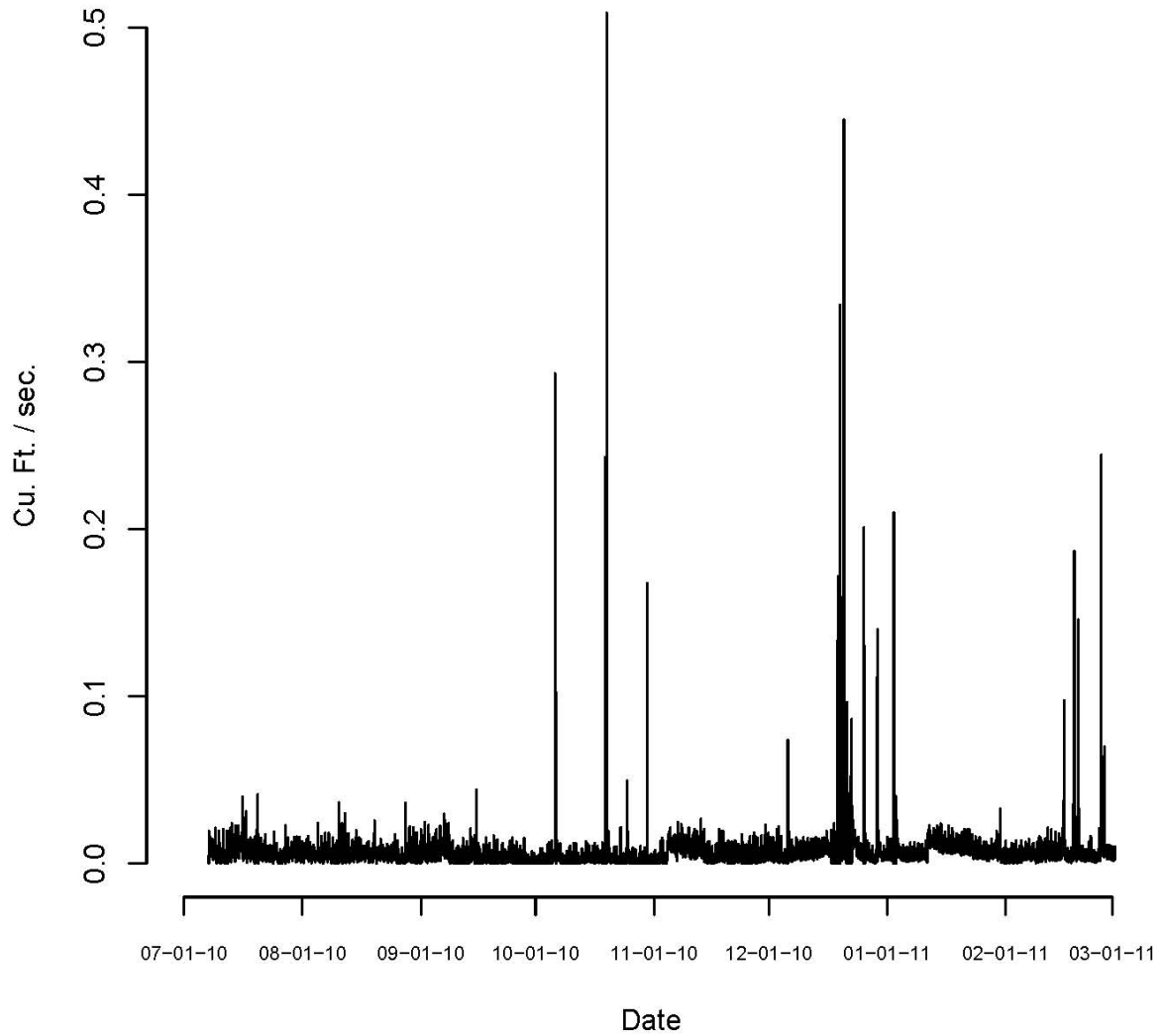


Q-Q Plot for 3O_VERSEP Flows

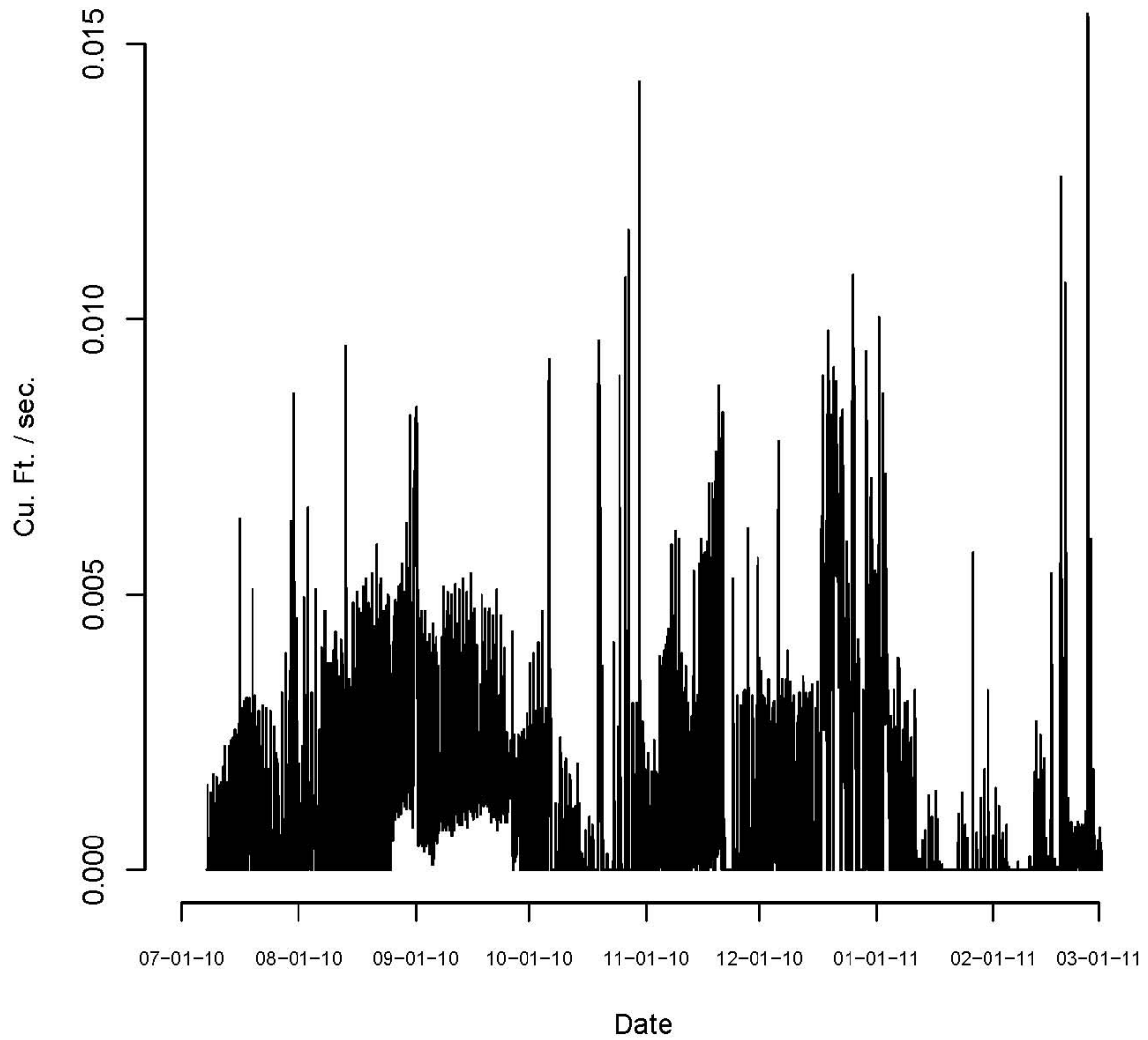


Appendix E-3 - Sample Site Flow Rate Time Series Graphs

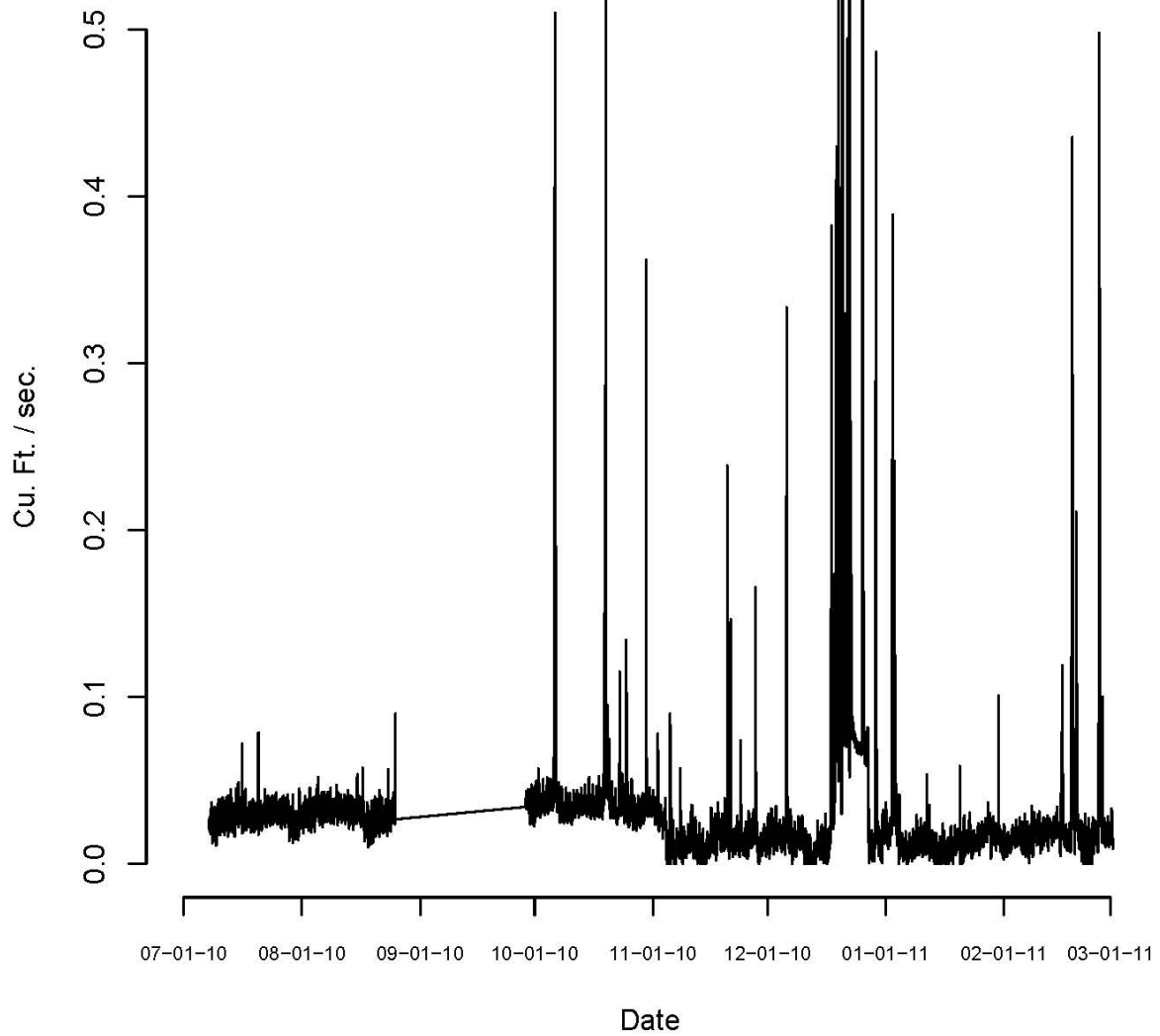
Time Series for 10_ACAD Flows



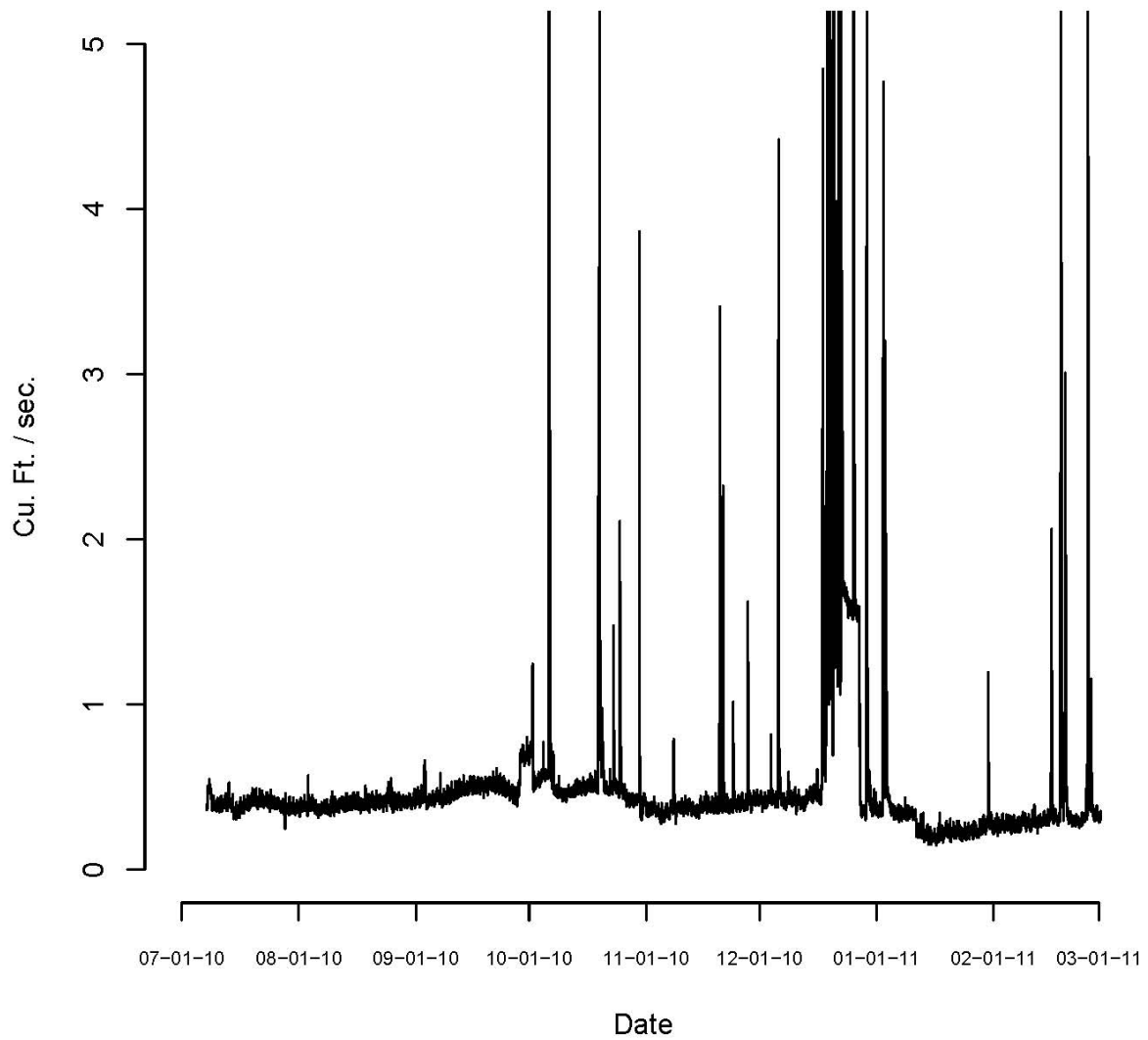
Time Series for 10_EAST Flows



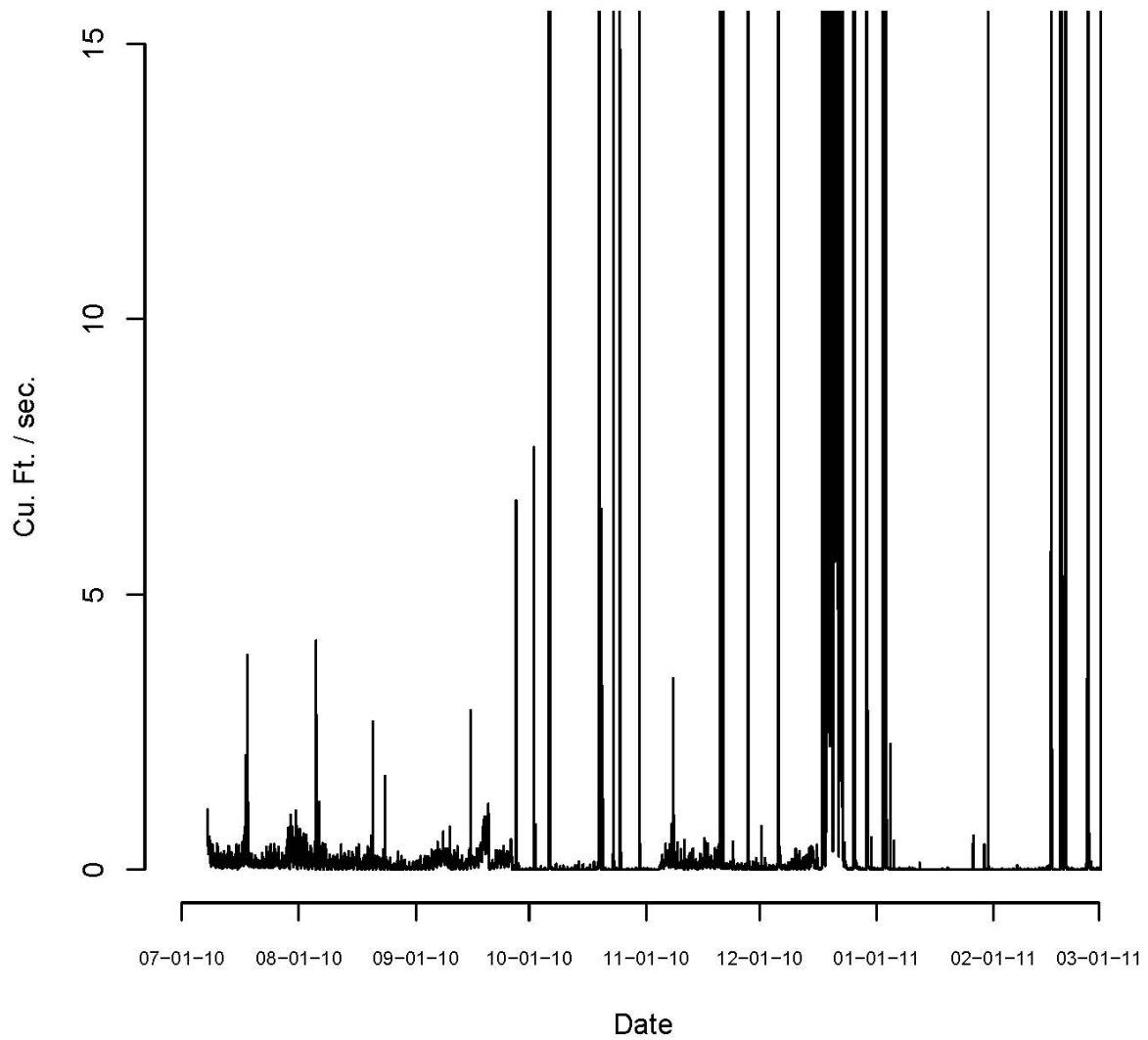
Time Series for 3I_ASHB Flows



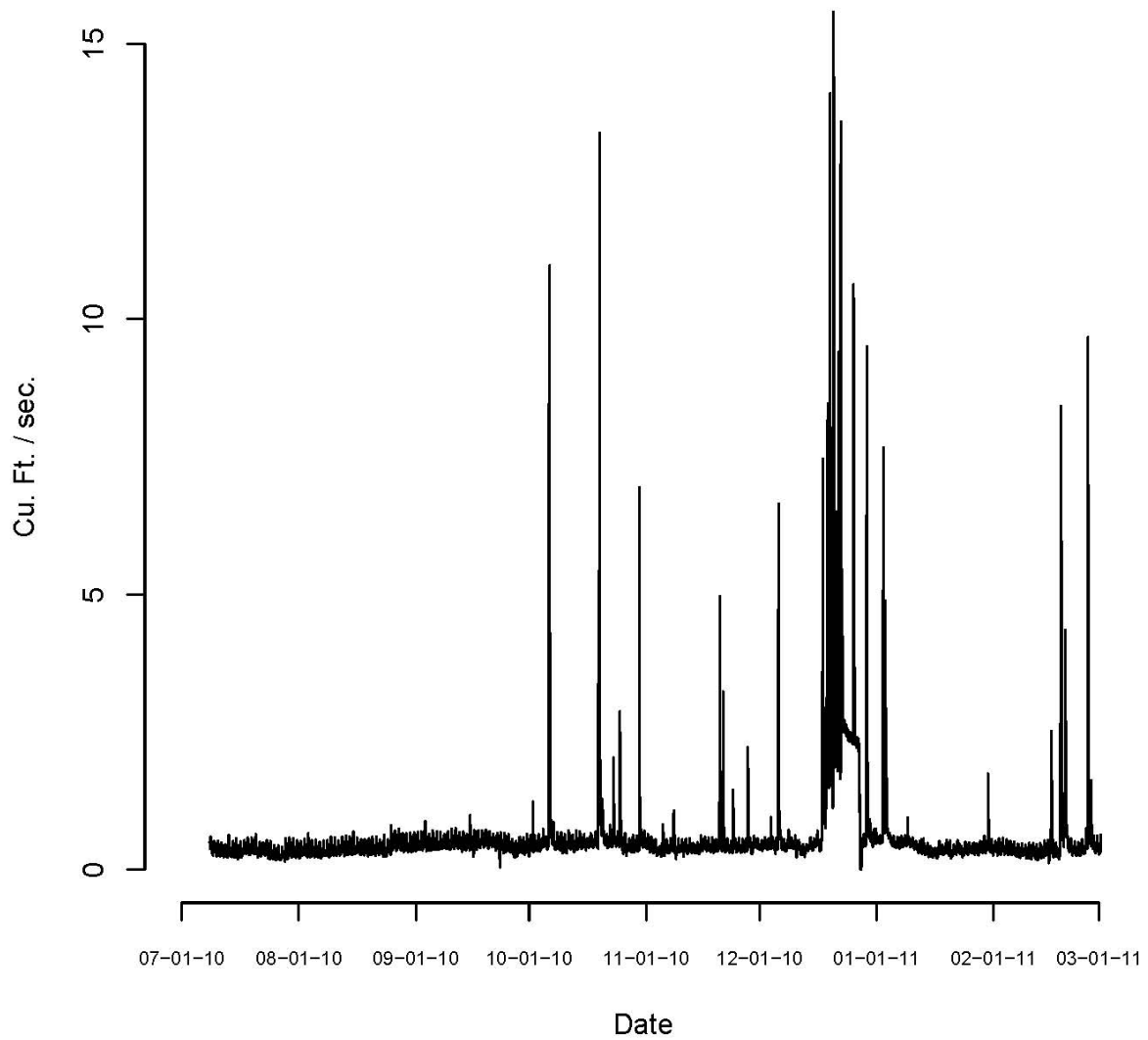
Time Series for 3I_NORMP Flows



Time Series for 30_VAND Flows



Time Series for 30_VERSEP Flows



Appendix F - Analysis of Variance (ANOVA) of Dry Weather Water Quality Samples

Effect Tests

The entirety of the dry weather sampling data was reviewed, confirmed, and cleaned for analysis. All non-detect data was assigned the value of the minimum detection limit for the proceeding analysis. The sampling data was separated by constituent and, as necessary, fraction. From these subsets of data, a linear regression was performed upon each parameter by site and by event. For this analysis, data from 1O_EAST was not considered because of the limited number of data points collected from the site.

First, a partial-F test, or effect test, was performed to see if the means of the distributions of constituent data by site and by event were equal. This hypothesis was meant to determine whether individual parameter distributions per site or per event could be shown, to a 95 % confidence level, that they were part of the same parameter distribution across all sites and events. A result of the probability of this hypothesis (i.e. greater than F) being less than 0.05 was presumed to indicate that the individualized distributions by parameter (i.e. site or event) may be different than the overall distribution, and therefore the parameter may be significant in determining the resulting pollutant concentration and would warrant further inspection. Special consideration was given to probabilities approximating 0.05 as the sample size for each parameter was small.

Second, a plot of the residuals versus the predicted value was observed to determine if the data should be transformed logarithmically before further inspection. If residuals were observed to deviate from 0 as the predicted values increased, a logarithmic transformation was considered necessary.

The data was grouped into categories based upon whether site, event, neither or both parameters were considered possibly significant and whether the data set required logarithmic transformation or not.

No immediate pattern or categories of constituents were identified as a result of this analysis. A majority of constituents were found to require logarithmic transformation, which is typical for environmental data. Total copper, total nitrogen, and dissolved phosphorous were shown to need logarithmic transformation and indicate the possibility of both site and event exhibiting significant impact on the constituent concentration. Only those 3 of 16 considered constituents exhibited a possible impact from both site location and event date, and those constituents were of different fractions and categories (i.e. metals, nutrients) potentially implied that these patterns were not consistent and may be the result of natural variations. Furthermore, *E. coli*, total kjeldahl nitrogen, and total suspended solids were shown to need logarithmic transformation but showed no possible significant impact from site or event. Ammonia, total lead, dissolved lead, nitrate, nitrite, and orthophosphate were shown to need logarithmic transformation and indicated the possibility of site location impacting the respective pollutant concentrations. Hardness and total dissolved solids were found to be possibly related to site location and without the need for

logarithmic transformation. Only dissolved copper was found to be possibly related to event and without the need log transformation.

Effect Test and Residual Graph Results

The results of the effect tests and graphs of residual by predicted concentrations for each constituent are presented below.

Table F-1 - Effect Test Results for Ammonia

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
SiteId	4	4	0.23849220	5.2318	0.0047*
Event	5	5	0.04230480	0.7424	0.6008

*Possible statistical significance ($p < 0.05$)

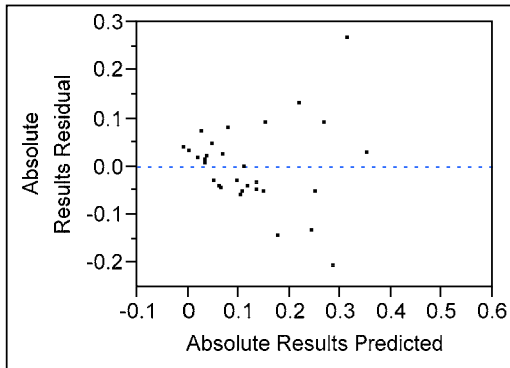


Figure F-1 - Residual by Predicted Plot for Ammonia

Table F-2 - Effect Test Results for Dissolved Copper

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
SiteId	4	4	55.64598	1.0736	0.3957
Event	5	5	204.08262	3.1500	0.0294*

*Possible statistical significance ($p < 0.05$)

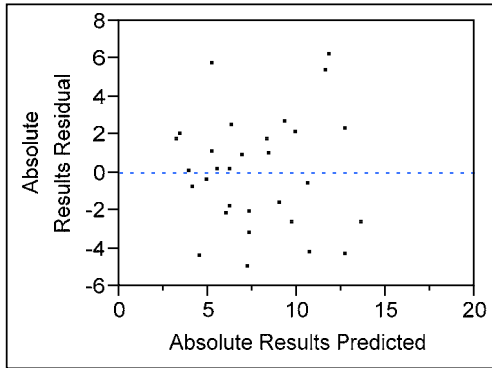


Figure F-2 - Residual by Predicted Plot for Dissolved Copper

Table F-3 - Effect Test Results for Total Copper

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	235.20533	2.8972	0.0483*
Event	5	5	298.75367	2.9440	0.0377*

*Possible statistical significance ($p < 0.05$)

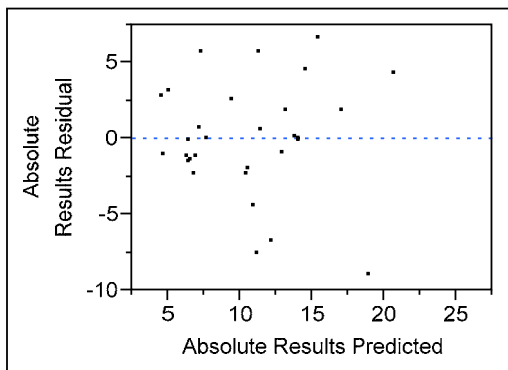


Figure F-3 - Residual by Predicted Plot for Total Copper

Table F-4 - Effect Test Results for *E. coli*

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	125406870	1.4983	0.2404
Event	5	5	86664629	0.8284	0.5445

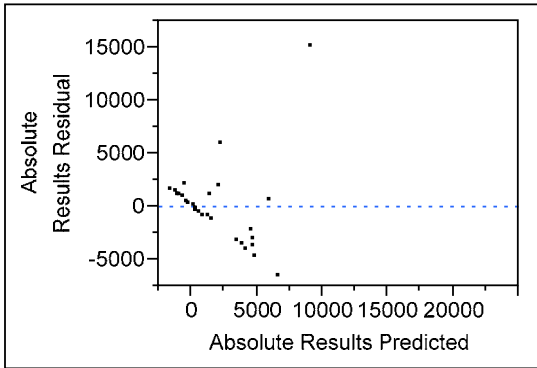


Figure F-4 - Residual by Predicted Plot for *E. coli*

Table F-5 - Effect Test Results for Hardness

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	2678246.7	35.2222	<.0001*
Event	5	5	140456.7	1.4777	0.2412

*Possible statistical significance ($p < 0.05$)

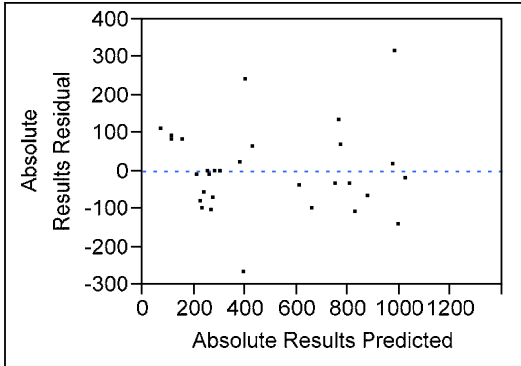


Figure F-5 - Residual by Predicted Plot for Hardness

Table F-6 - Effect Test Results for Total Kjeldahl Nitrogen

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	38.590613	1.3447	0.2882
Event	5	5	42.474190	1.1840	0.3519

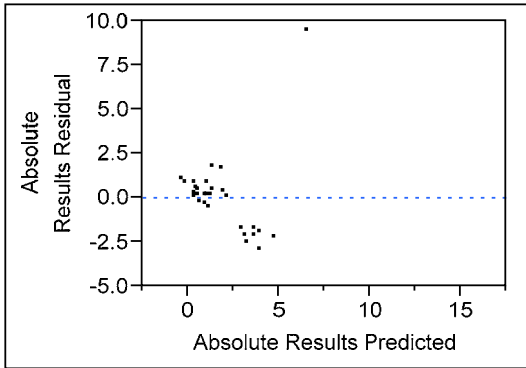


Figure F-6 - Residual by Predicted Plot for Total Kjeldahl Nitrogen

Table F-7 - Effect Test Results for Dissolved Lead

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	0.62070247	4.7537	0.0074*
Event	5	5	0.21657520	1.3269	0.2931

*Possible statistical significance (p < 0.05)

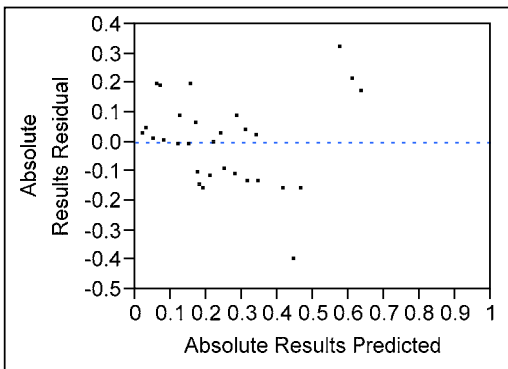


Figure F-7 - Residual by Predicted Plot for Dissolved Lead

Table F-8 - Effect Test Results for Total Lead

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	69.919447	3.1486	0.0368*
Event	5	5	37.585280	1.3540	0.2830

*Possible statistical significance (p < 0.05)

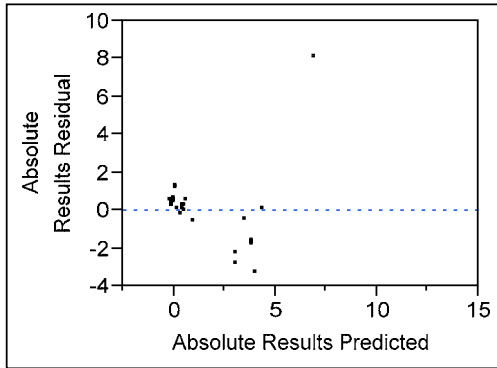


Figure F-8 - Residual by Predicted Plot for Total Lead

Table F-9 - Effect Test Results for Nitrate

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	106.05903	7.0620	0.0010*
Event	5	5	11.51534	0.6134	0.6909

*Possible statistical significance ($p < 0.05$)

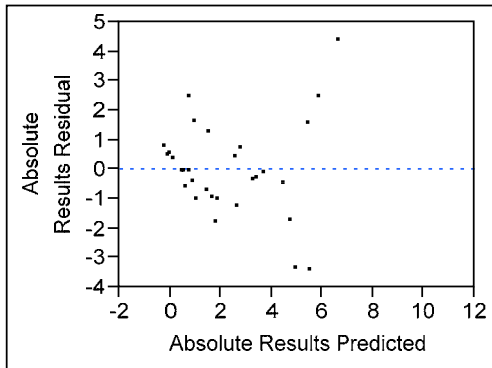


Figure F-9 - Residual by Predicted Plot for Nitrate

Table F-10 - Effect Test Results for Nitrite

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	0.01948600	1.7687	0.1748
Event	5	5	0.01804697	1.3104	0.2994

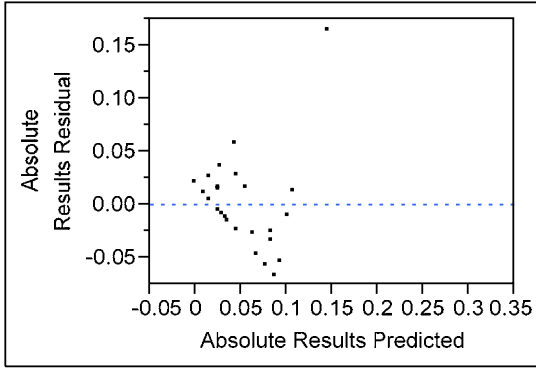


Figure F-10 - Residual by Predicted Plot for Nitrite

Table F-11 - Effect Test Results for Total Nitrogen

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	78.686621	2.1999	0.1058
Event	5	5	88.113821	1.9708	0.1272

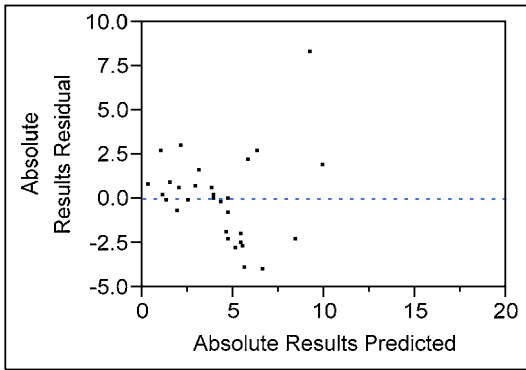


Figure F-11 - Residual by Predicted Plot for Total Nitrogen

Table F-11 - Effect Test Results for Orthophosphate

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	0.44771813	2.1306	0.1146
Event	5	5	0.33860520	1.2891	0.3077

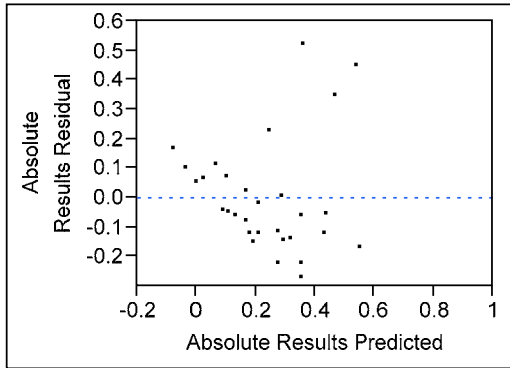
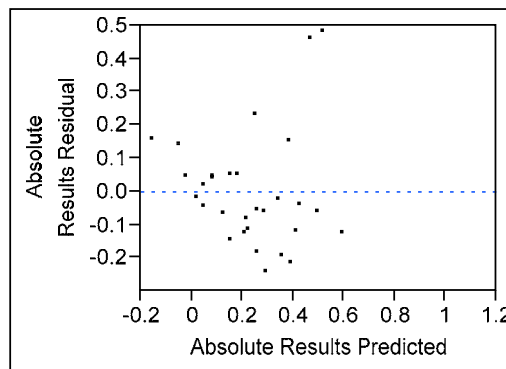


Figure F-12 - Residual by Predicted Plot for Orthophosphate

Table F-13 - Effect Test Results for Total Dissolved Phosphorous

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	0.29682647	1.7101	0.1873
Event	5	5	0.67382387	3.1057	0.0310*



*Possible statistical significance ($p < 0.05$)

Figure F-13 - Residual by Predicted Plot for Total Dissolved Phosphorous

Table F-14 - Effect Test Results for Total Dissolved Solids

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	6485799.5	4.6634	0.0080*
Event	5	5	2294360.7	1.3198	0.2958

*Possible statistical significance ($p < 0.05$)

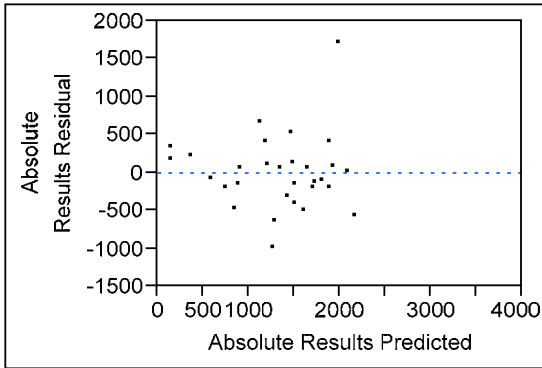


Figure F-14 - Residual by Predicted Plot for Total Dissolved Solids

Table F-15 - Effect Test Results for Total Phosphorous

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	0.83725133	2.5396	0.0719
Event	5	5	0.73222417	1.7768	0.1635

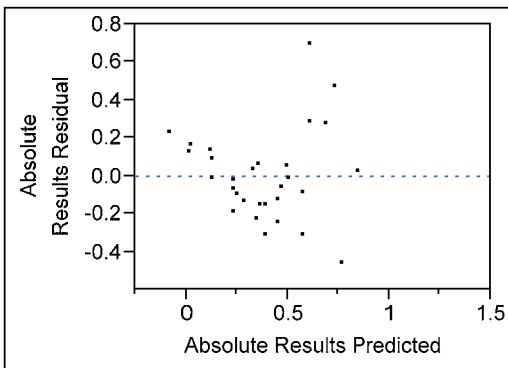


Figure F-15 - Residual by Predicted Plot for Total Phosphorous

Table F-16 - Effect Test Results for Total Suspended Solids

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	2646.1913	1.4678	0.2492
Event	5	5	3358.9617	1.4905	0.2372

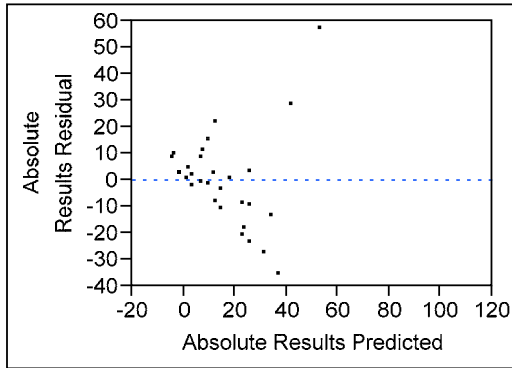


Figure F-16 - Residual by Predicted Plot for Total Suspended Solids

Logarithmic transformations

Once the constituents were grouped based on the results of effect tests and residual plots, data that was determined to require logarithmic transformation was replaced with the natural log of the original value of concentration. Occasionally, the resulting transformations found a parameter, which was previously identified as possibly significant through effect tests, was no longer significant through observation of the lognormally transformed data. This is not unexpected as the sample sizes were small and indicated that the possible pattern was actually statistical noise. Total suspended solids and *E. coli* distributions still exhibited neither parameter as possibly significant after logarithmic transformation of the data. Dissolved lead and Nitrate distributions, which initially exhibited possible significance from the parameter of site, did not exhibit possible significance from either parameter after logarithmic transformation. The total copper distribution, which had previously exhibited possible significance from both site and event, exhibited parameter as possibly significant after logarithmic transformation. In these instances, further analysis of the distributions was not considered as deviations could not be segregated from statistical noise.

Table F-17 - Effect Test Results for Total Copper after Logarithmic Transformation

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Event	5	5	2.7032191	2.6782	0.0521
Siteld	4	4	1.7799363	2.2043	0.1053

Table F-18 - Effect Test Results for E. coli after Logarithmic Transformation

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	32.786698	1.3495	0.2866

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Event	5	5	22.428318	0.7385	0.6035

Table F-19 - Effect Test Results for Dissolved Lead after Logarithmic Transformation

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	7.0331747	2.7391	0.0512

Table F-20 - Effect Test Results for Nitrite after Logarithmic Transformation

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	4.1356394	2.3724	0.0795

Table F-21 - Effect Test Results for Total Suspended Solids after Logarithmic Transformation

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Siteld	4	4	14.792132	2.7853	0.0546
Event	5	5	5.914627	0.8910	0.5057

Least-Squares Means and Prediction Profiles

Following the transformations where necessary, least-squares means plots were created for any parameters determined to be potentially significant to the concentration. Both parameters were considered for constituents that did not exhibit any potential significance prior to log transformation (e.g. *E. coli*, TKN, and TSS). These plots estimated means and error bars associated with the individual distributions of the constituents by the selected parameters of site or event, respectively. If the individual distribution's mean is observed to deviate significantly from the overall distribution mean, then one cannot say with 95 % confidence that the individual distribution for the site or event is the same as the overall distribution. Instances where confidence did not reach the 95 % threshold led the difference between the individual distribution and the overall distribution to be declared statistically significant.

Comparison to the overall distribution mean was observed through a prediction profile graph and numerically verified through a scaled estimates table. The individual distributions whose differences in mean found to be statistically significant were catalogued.

Total Nitrogen, which was found to only be potentially significant by site after log transformation, identified the means of distributions of 1O_ACAD and 3I_ASHB to be statistically different than the overall distribution. Total Phosphorous, which was found to only be potentially significant by site after log transformation, identified the means of distributions of Event 2 and Event 6 had statistically significant differences from the overall distributions. Total kjeldahl nitrogen, which was found to be potentially significant by site after log transformation, identified statistically significant differences in means at 1O_ACAD and 3O_VERSEP. Other parameters similarly identified that several of the sites or events had statistically significant differences in means from the overall distribution. Only the individual site distributions for hardness were found to be statistically different from the overall distribution at all sites. However, no clear, consistent, and statistically confident pattern arose across constituents. The following figures present the relevant least-squares means plots and prediction profiles for parameters observed for each constituent undergoing least-squared means analysis.

Figure F-17 - Least-Squares Means and Prediction Profile Plots for Ammonia by Site

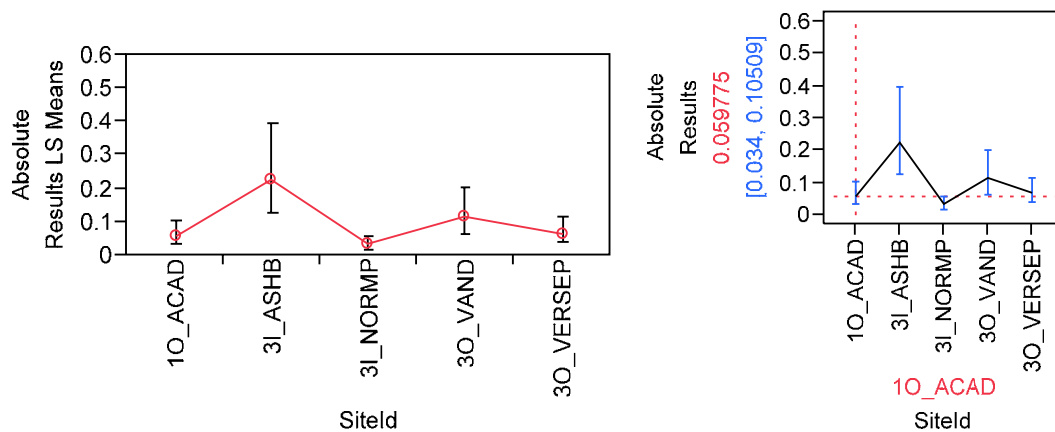


Figure F-18 - Least-Squares Means and Prediction Profile Plots for Hardness by Site

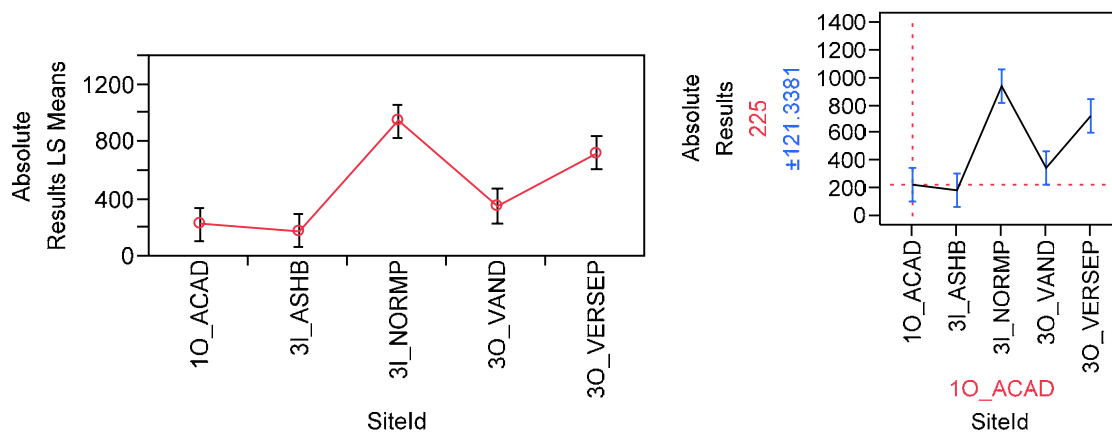


Figure F-19 - Least-Squares Means and Prediction Profile Plots for Total Kjeldahl Nitrogen by Site

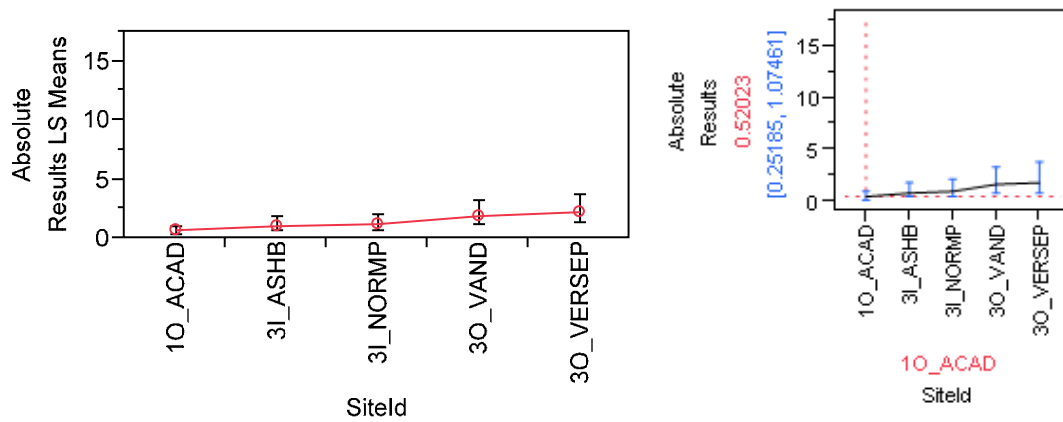


Figure F-20 - Least-Squares Means and Prediction Profile Plots for Total Lead by Site

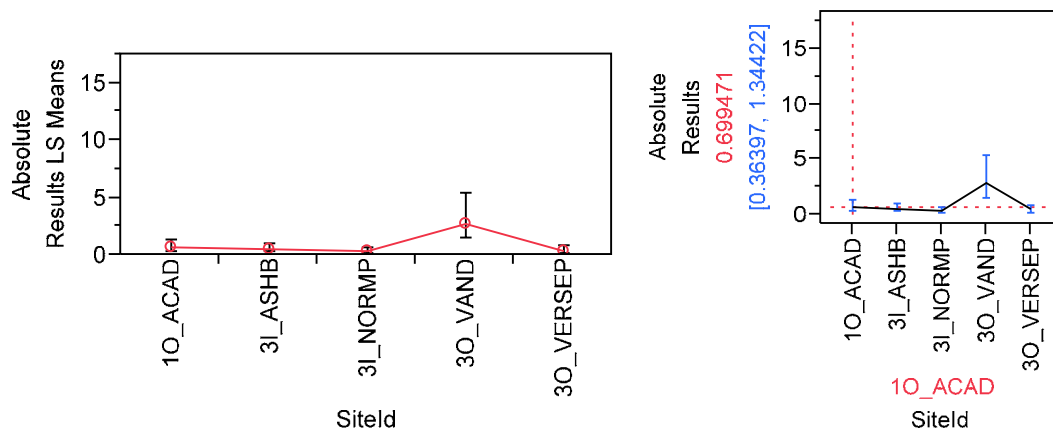


Figure F-21 - Least-Squares Means and Prediction Profile Plots for Nitrate by Site

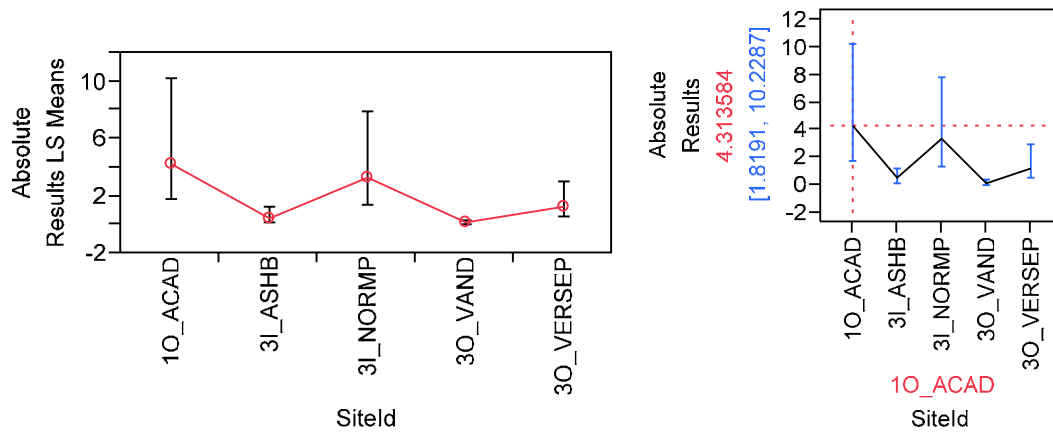


Figure F-22 - Least-Squares Means and Prediction Profile Plots for Total Nitrogen by Site

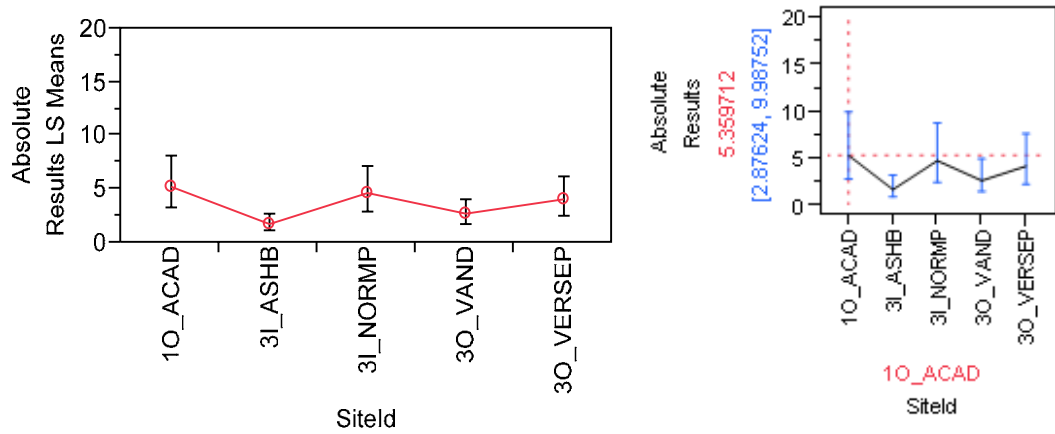


Figure F-23 - Least-Squares Means and Prediction Profile Plots for Orthophosphate by Site

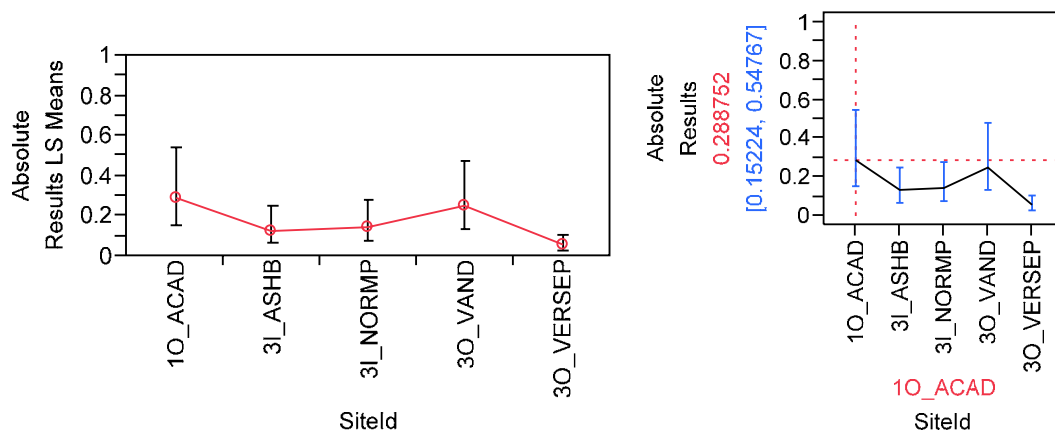


Figure F-24 - Least-Squares Means and Prediction Profile Plots for Total Phosphorous by Event

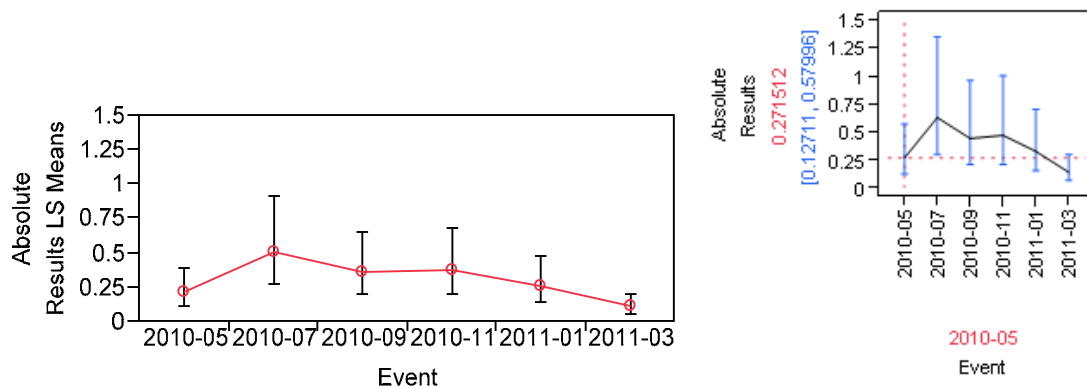


Figure F-25 - Least-Squares Means and Prediction Profile Plots for Total Dissolved Phosphorous by Event

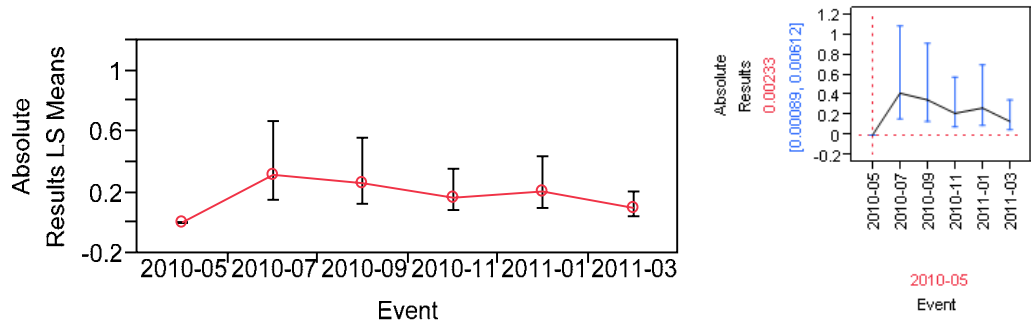
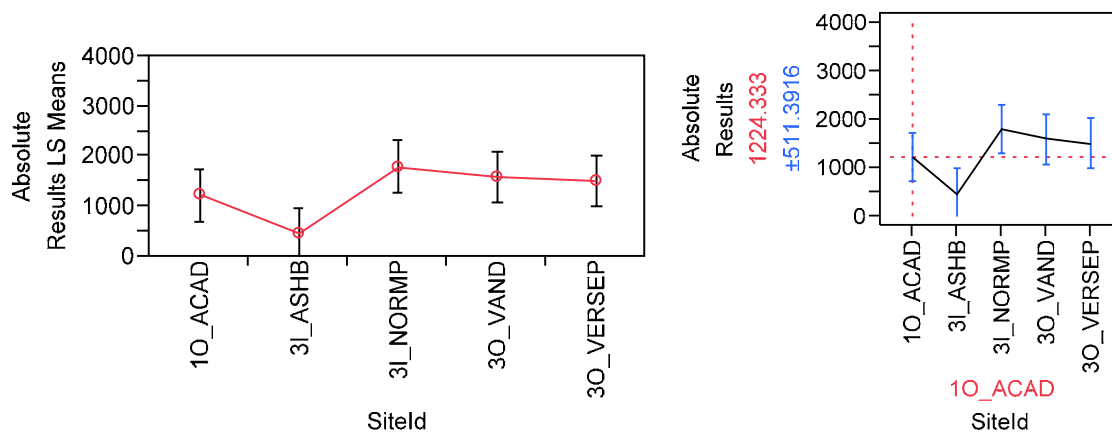


Figure F-26 - Least-Squares Means and Prediction Profile Plots for Total Dissolved Solids by Site



Conclusions

The overall identifications of statistically significant differences from the analysis are presented below in **Table F-22**.

Table F-22 - Summary of Identifications of Statistical Significance

Constituent	Effect Test Results		Least Squares Means and Prediction Profile Plot Results										
	Site	Event	10 ACAD	3I ASHB	3I NORMP	3O VAND	3O VERSEP	1	2	3	4	5	6
Total Suspended Solids													
Total Dissolved Solids	X			X	X								
Hardness	X		X	X	X	X	X						
Total Nitrogen	X		X	X									
Total Kjeldahl Nitrogen	X		X				X						
Nitrate	X		X		X	X							
Nitrite													
Ammonia	X			X	X		X						
Total Phosphorous		X							X				X
Dissolved Phosphorous		X						X	X	X		X	
Ortho-phosphate	X		X				X						
Total Copper													
Dissolved Copper		X						X	X				
Total Lead	X						X						
Dissolved Lead													
<i>E. coli</i>													

Ultimately, no factors or sites were identified to consistently be creating unique distributions for concentrations of parameters. It may be possible that there are differences in the constituent distributions by site and event, but there is available evidence that can be used to have them serve as predictions of future concentrations, as the underlying differences are not understood. As there was no pattern of differences across multiple constituents or between groups of constituents, it was concluded that the most reasonable course of action would be to treat all samples as part of one distribution across the watershed.

Appendix G-1 - Regression on Order Statistics of Water Quality Constituents Reporting Non-Detect Values

The regression on order statistics analysis was performed through the use of LWA Data Analysis Tool version 1.8, which is modeled of the Caltrans program for analyzing environmental data with non-detect values. All regressions returned distributions with high confidence, indicating that the distribution of the constituent data is accurately represented through these lognormal approximations.

Table G-1-1 - Regression on Order Statistics Results

Constituent	n	n detected	Percent detected	Lognormal Mean	Lognormal Standard Deviation	Correlation Coefficient
Nitrite (mg/L)	32	11	34.38%	-4.0592	1.6286	97.42%
Nitrate (mg/L)	32	31	96.88%	0.1385	1.5026	93.71%
Dissolved Phosphorous (mg/L)	32	28	87.50%	-1.9481	1.3359	98.61%
Dissolved Lead (µg/L)	31	30	96.77%	-1.8084	1.0112	98.46%
Dissolved Copper (µg/L) ¹	31	30	96.77%	1.8534	0.6688	96.87%
E Coli (MPN / 100 mL)	31	28	90.32%	4.9773	2.8366	99.32%
Ammonia (mg/L)	32	30	93.75%	-2.4350	1.1524	98.24%

1. Dissolved Copper was found to be more appropriately identified as a normal distribution after further review. As dissolved copper contained a non-detect value, the regression's calculated normal mean and standard deviation of 7.5588 and 4.2453 µg/L, respectively, were used for the constituent's simulated distribution.

Appendix G-2 Frequency Distribution Analysis of Detected Water Quality Constituents

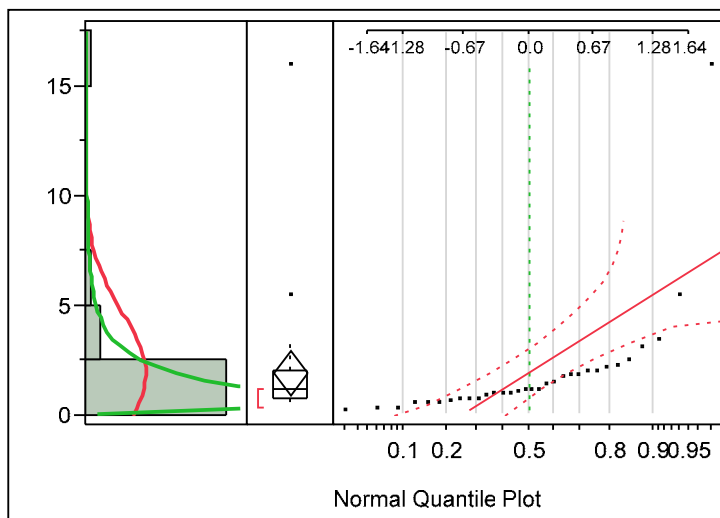
Frequency Distributions

Once a data for an individual constituent was selected, a best fit estimation for both normal and lognormal frequency distribution fits were created through the statistical program, JMP. These two distributions were selected as they are the distributions that occur most often within environmental data and no evidence suggested that other distributions would be identifiable within the data procured.

After the creation of the two distribution fits, a goodness of fit test was applied to each. A Shapiro-Wilk W test was applied to the fitted normal distribution and a Kolgomorov D test was applied to the fitted lognormal distribution. The tests determine the probability of a data point belonging to the fitted distribution. Thus, the test that presented a higher probability was selected.

The dissolved copper test indicated that the normal distribution served as a better fit, and thus the resulting mean and standard deviation derived from the regression on order statistics program was used to better accommodate the non-detect values within the distribution.

The nitrate tests indicated that normal, lognormal, and exponential distributions failed to appropriately fit the distribution of data and all resulting distributions significantly overestimated concentrations of nitrogen. This prompted the decision to separate the data into two separate distributions reflecting its behavior near the detection limit and well above the detection limit.



- Normal(1.93563,2.78371)
- LogNormal(0.24307,0.81766)

Figure G-2-1 - Frequency Distribution for Total Kjeldahl Nitrogen

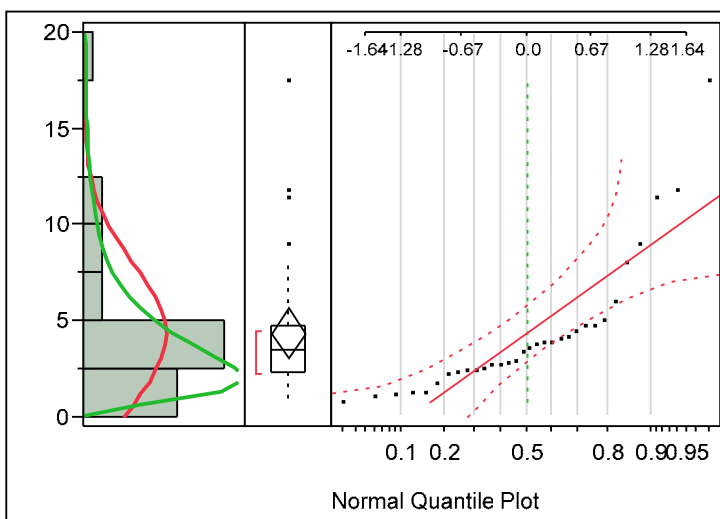
Table G-2-1 - Goodness of Fit Tests for Total Kjeldahl Nitrogen

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.477460	<.0001*	0.092112	> 0.1500

*Possible statistical significance (p < 0.05)

Distributions Constituent=Nitrogen, fraction=Total

Absolute Results



— Normal(4.35413,3.63179)

— LogNormal(1.20878,0.71322)

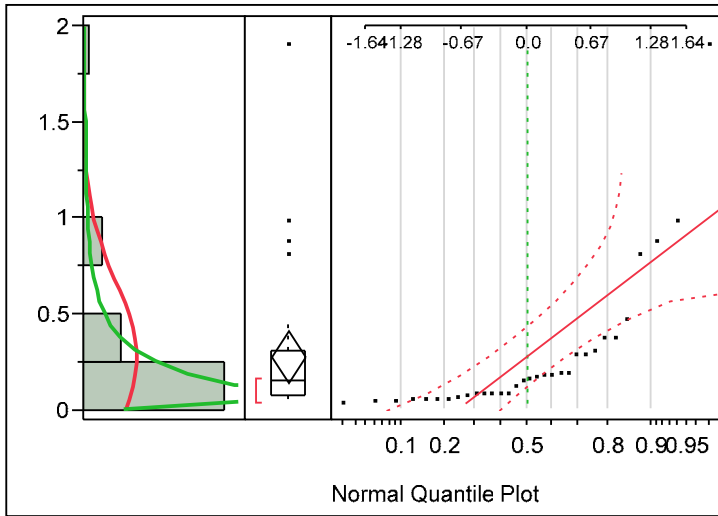
Figure G-2-2 - Frequency Distribution for Total Nitrogen

Table G-2-2 - Goodness of Fit Tests for Total Nitrogen

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.767885	<.0001*	0.098855	> 0.1500

*Possible statistical significance (p < 0.05)

Figure G-2-3 - Frequency Distribution for Orthophosphate



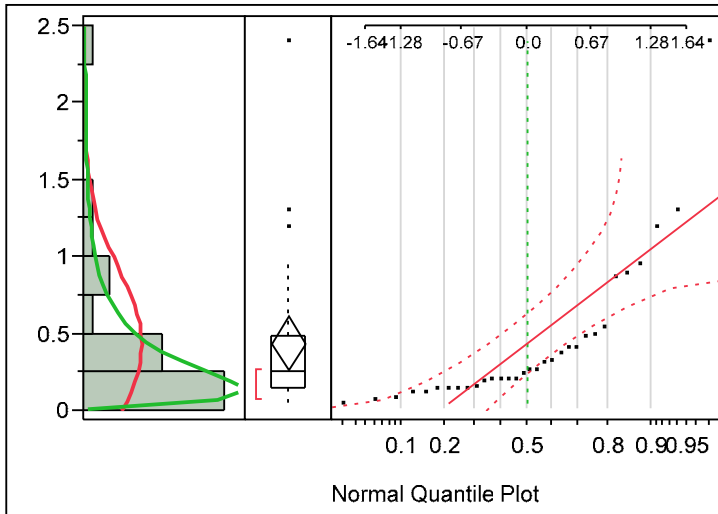
— Normal(0.28116,0.38371)
 — LogNormal(-1.8296,0.98789)

Table G-2-3 - Goodness of Fit Tests for Orthophosphate

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.622226	<.0001*	0.158363	0.0442*

*Possible statistical significance (p < 0.05)

Figure G-2-4 - Frequency Distribution for Total Phosphorous



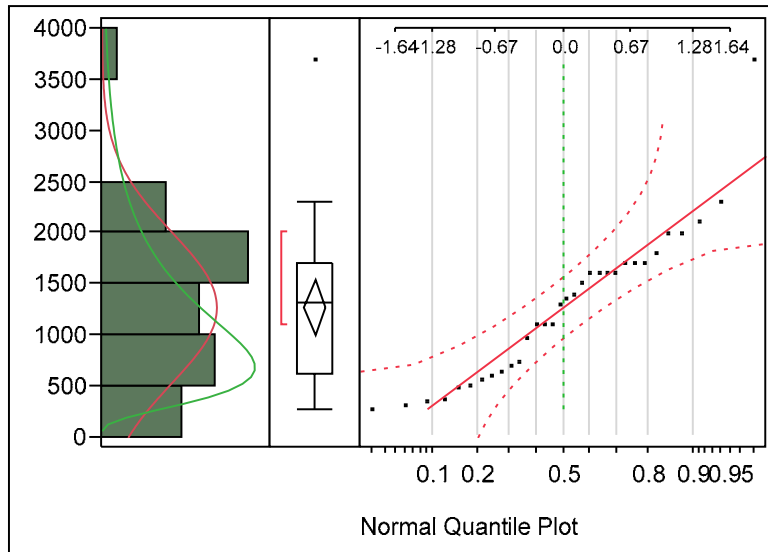
— Normal(0.43553,0.48489)
 — LogNormal(-1.2503,0.8826)

Table G-2-4 - Goodness of Fit Tests for Total Phosphorous

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.694003	<.0001*	0.106174	> 0.1500

*Possible statistical significance (p < 0.05)

Figure G-2-5 - Frequency Distribution for Total Dissolved Solids



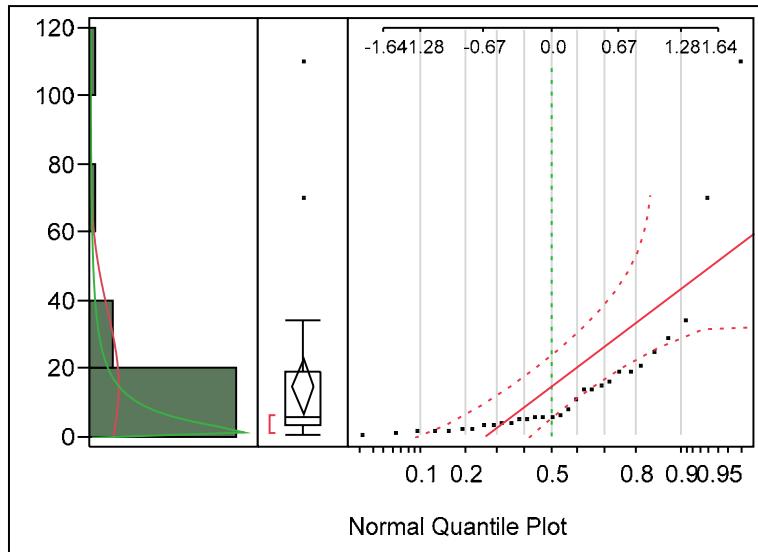
— Normal(1272.69,740.694)
 — LogNormal(6.96169,0.65132)

Table G-2-5 - Goodness of Fit Tests for Total Dissolved Solids

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.914774	0.0150*	0.156772	0.0465*

*Possible statistical significance (p < 0.05)

Figure G-2-6 - Frequency Distribution for Total Suspended Solids



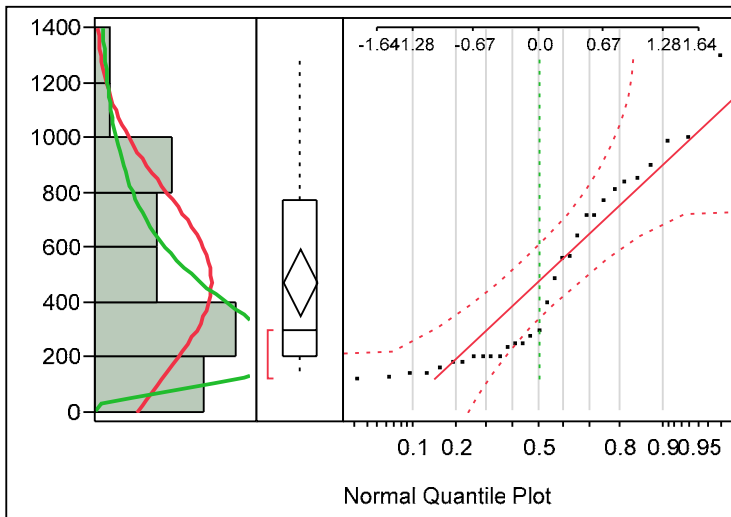
— Normal(15.029,22.4524)
 — LogNormal(1.97636,1.23654)

Table G-2-6 - Goodness of Fit Tests for Total Suspended Solids

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.604346	<.0001*	0.091093	> 0.1500

*Possible statistical significance (p < 0.05)

Figure G-2-7 - Frequency Distribution for Hardness



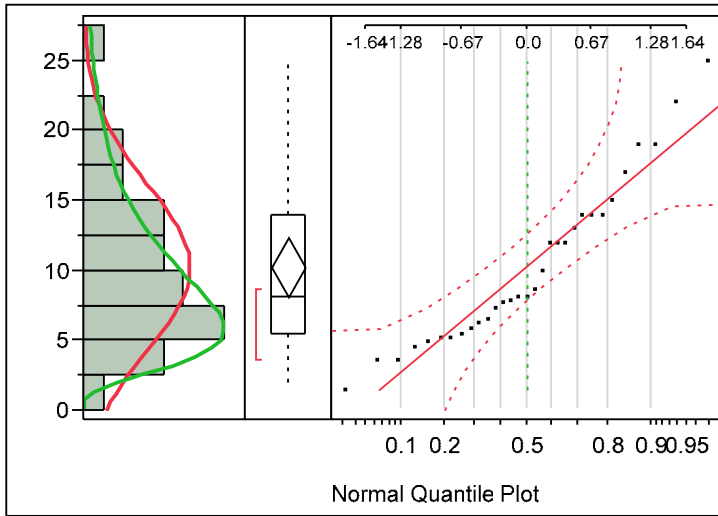
- Normal(475.161,332.414)
- LogNormal(5.90756,0.73161)

Table G-2-7 - Goodness of Fit Tests for Hardness

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.875254	0.0018*	0.152770	0.0649

*Possible statistical significance (p < 0.05)

Figure G-2-8 - Frequency Distribution for Total Copper

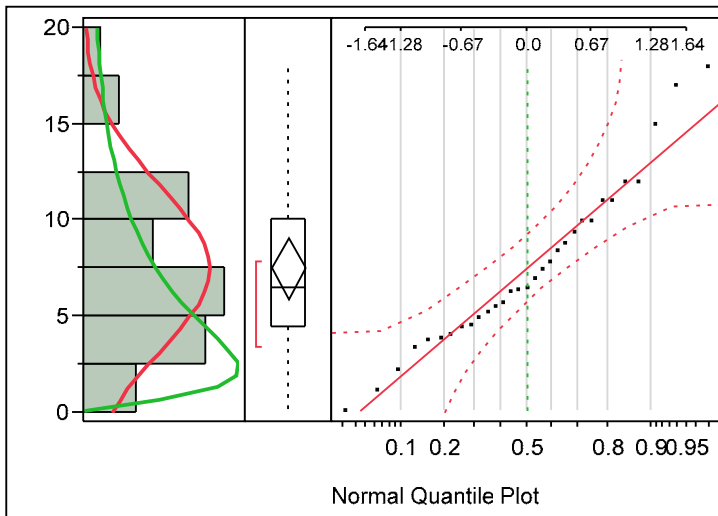


- Normal (10.2613,5.83385)
- LogNormal (2.15666,0.62072)

Table G-2-8 - Goodness of Fit Tests for Total Copper

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.935510	0.0620	0.120887	> 0.1500

Figure G-2-9 - Frequency Distribution for Dissolved Copper



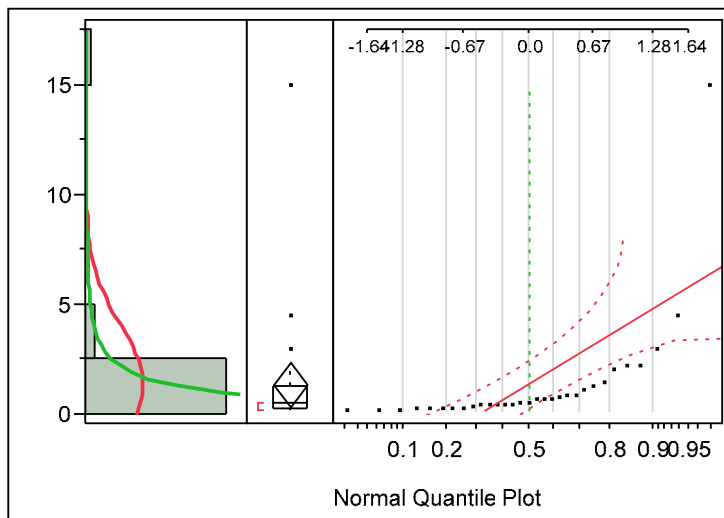
— Normal(7.51239,4.3207)
 — LogNormal(1.75515,0.96469)

Table G-2-9 - Goodness of Fit Tests for Dissolved Copper

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.957767	0.2544	0.202557	< 0.0100*

*Possible statistical significance (p < 0.05)

Figure G-2-10 - Frequency Distribution for Total Lead



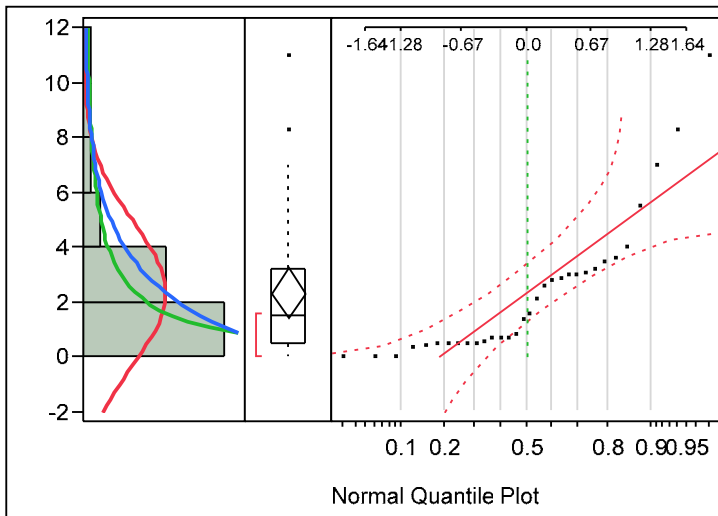
- Normal(1.36742,2.70843)
- LogNormal(-0.4026,1.03251)

Table G-2-10 - Goodness of Fit Tests for Total Lead

Normal Fit		Lognormal Fit	
W	Prob<W	D	Prob>D
0.426153	<.0001*	0.117739	> 0.1500

*Possible statistical significance (p < 0.05)

Figure G-2-11 - Frequency Distribution for Nitrate



- Normal(2.35959,2.5783)
- LogNormal(0.10256,1.52792)
- Exponential(2.35959)

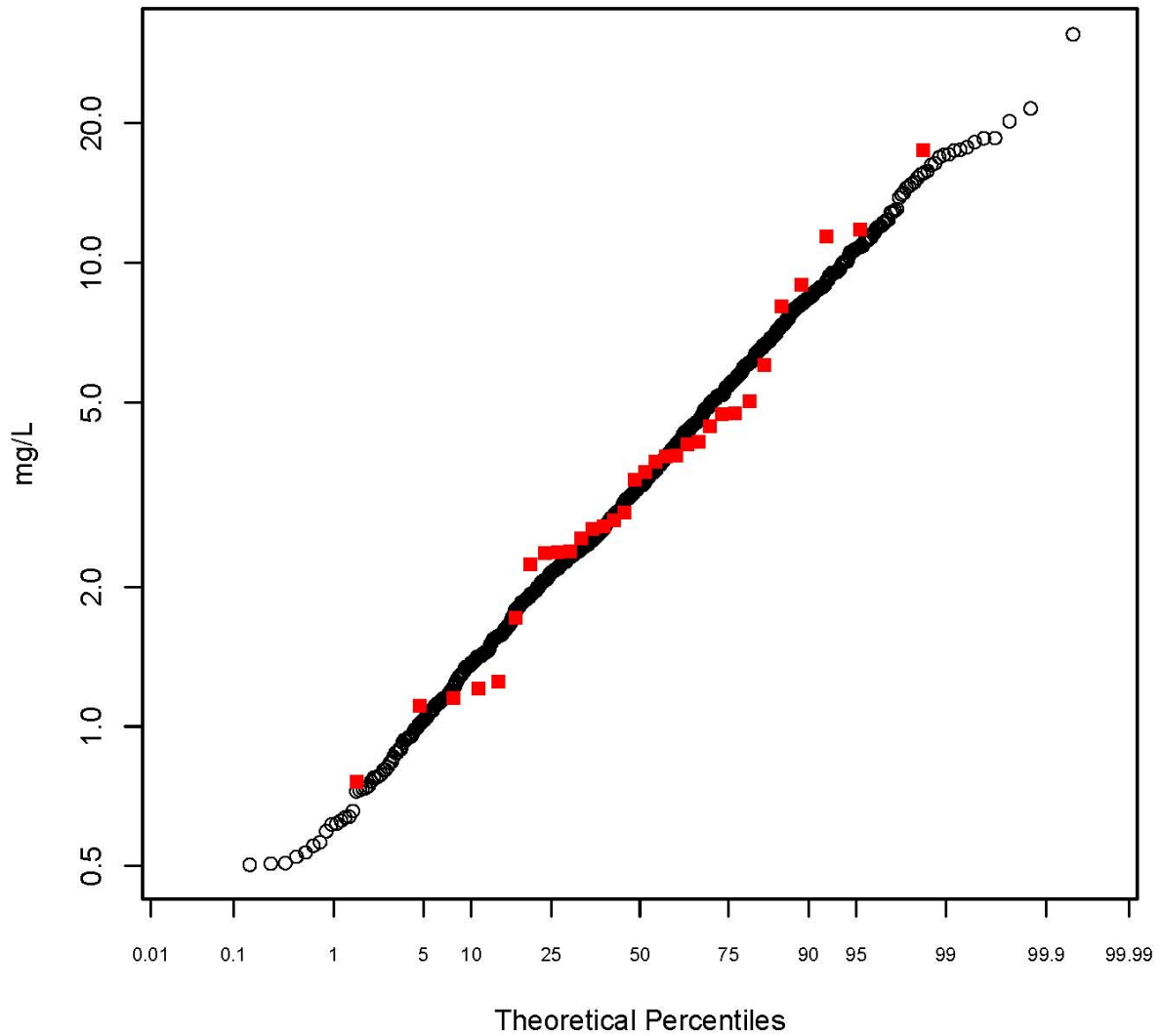
Table G-2-11 - Goodness of Fit Tests for Nitrate

Normal Fit		Lognormal Fit		Exponential Fit	
W	Prob<W	D	Prob>D	D	Prob>D
0.795569	<.0001*	0.158692	0.0438*	0.174522	0.0922

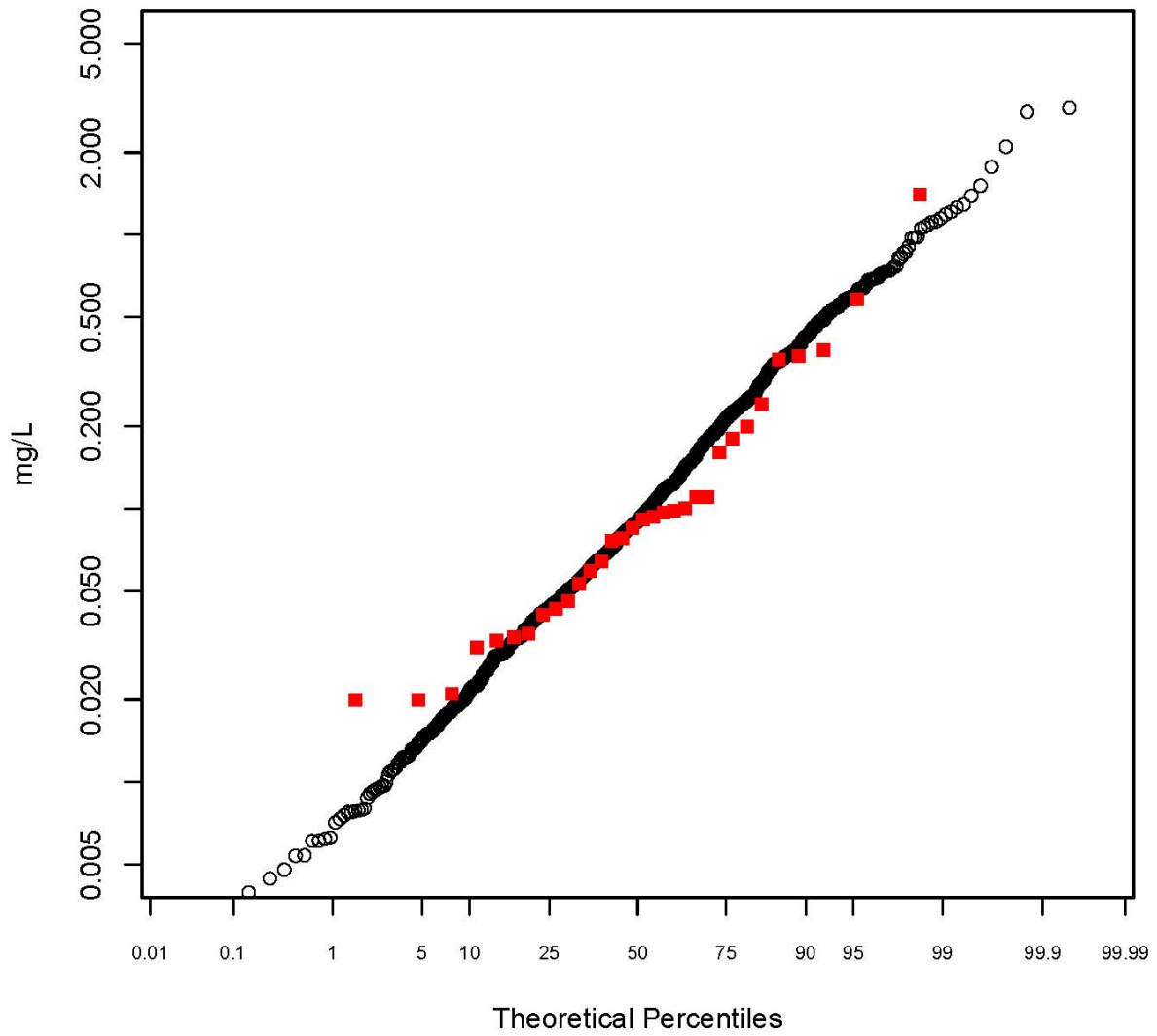
*Possible statistical significance (p < 0.05)

Appendix G-3 Simulated and Sampled Distributions of Water Quality Constituents

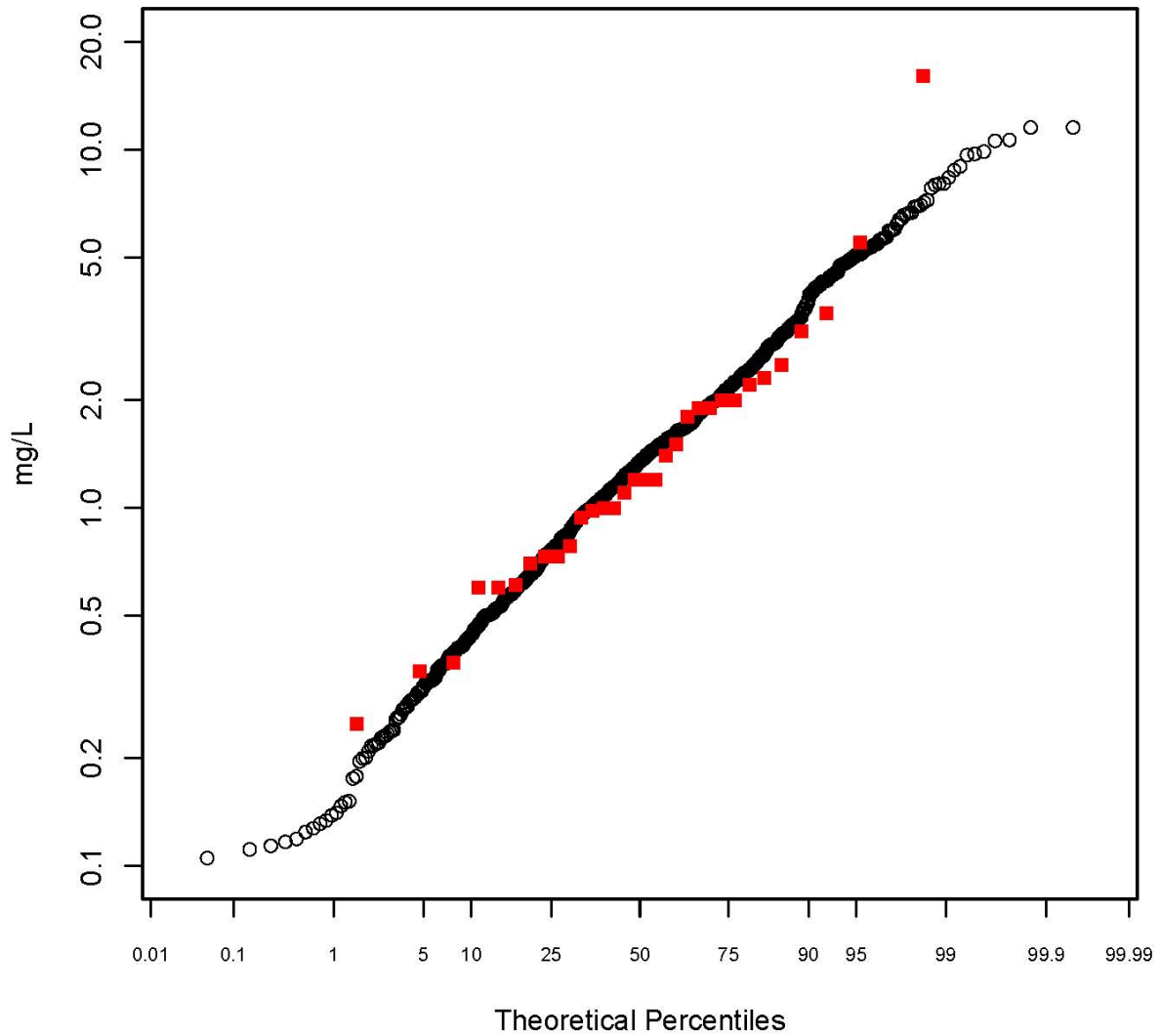
Q-Q Plot for Randomized and Sampled Total Nitrogen



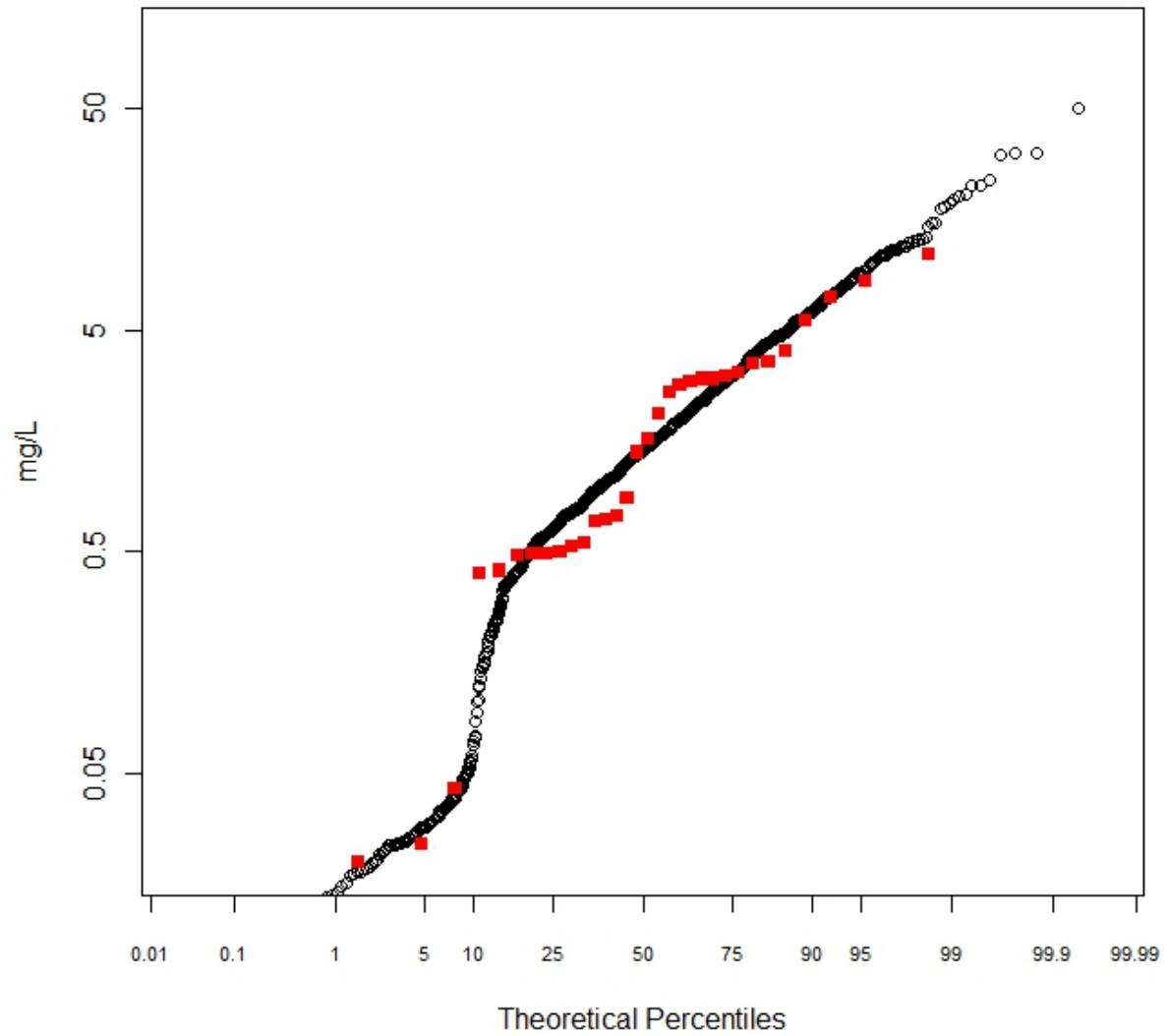
Q-Q Plot for Randomized and Sampled Ammonia



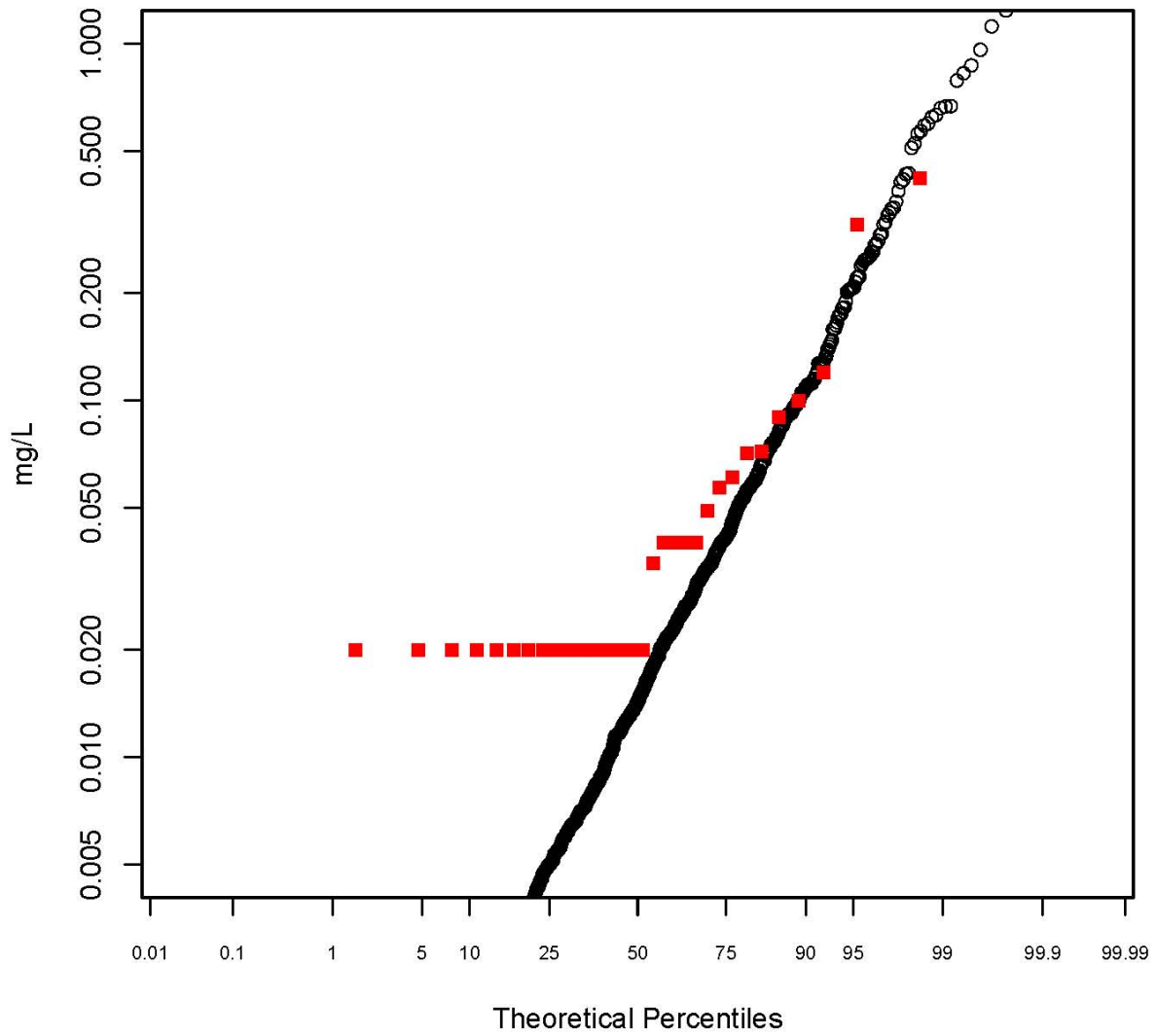
Q-Q Plot for Randomized and Sampled TKN



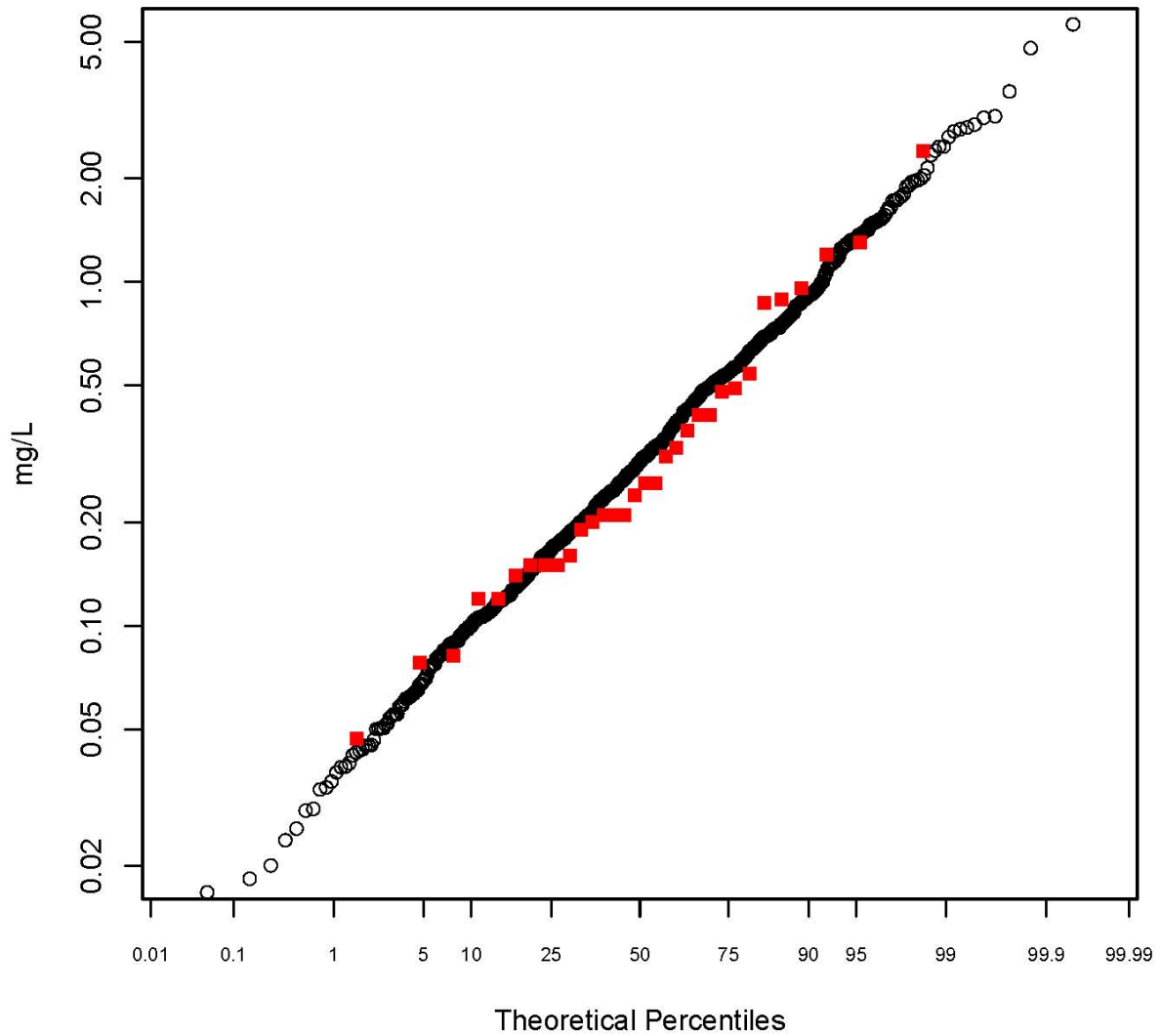
Q-Q Plot for Randomized and Sampled Nitrate



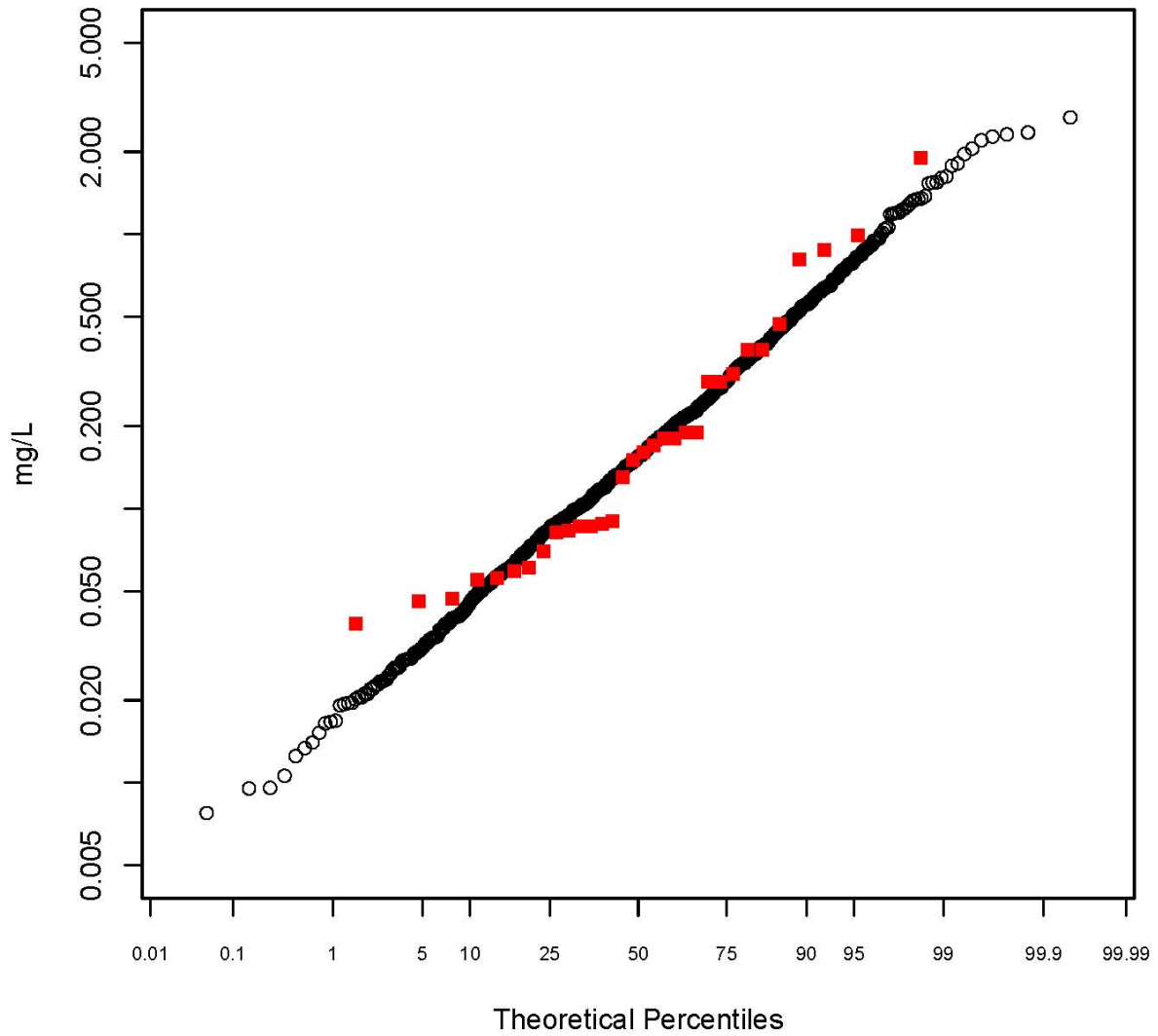
Q-Q Plot for Randomized and Sampled Nitrite



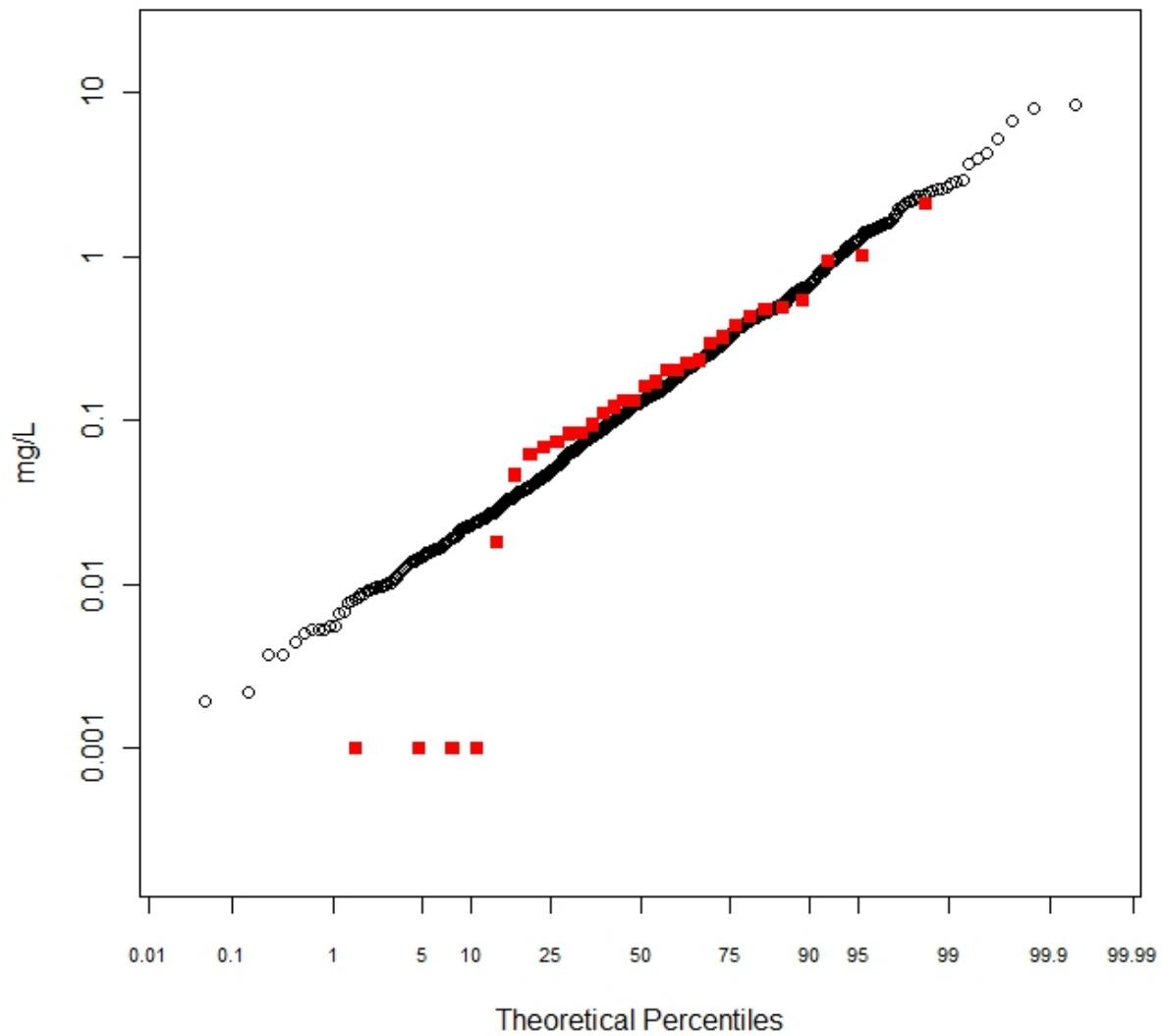
Q-Q Plot for Randomized and Sampled Total Phosphorous



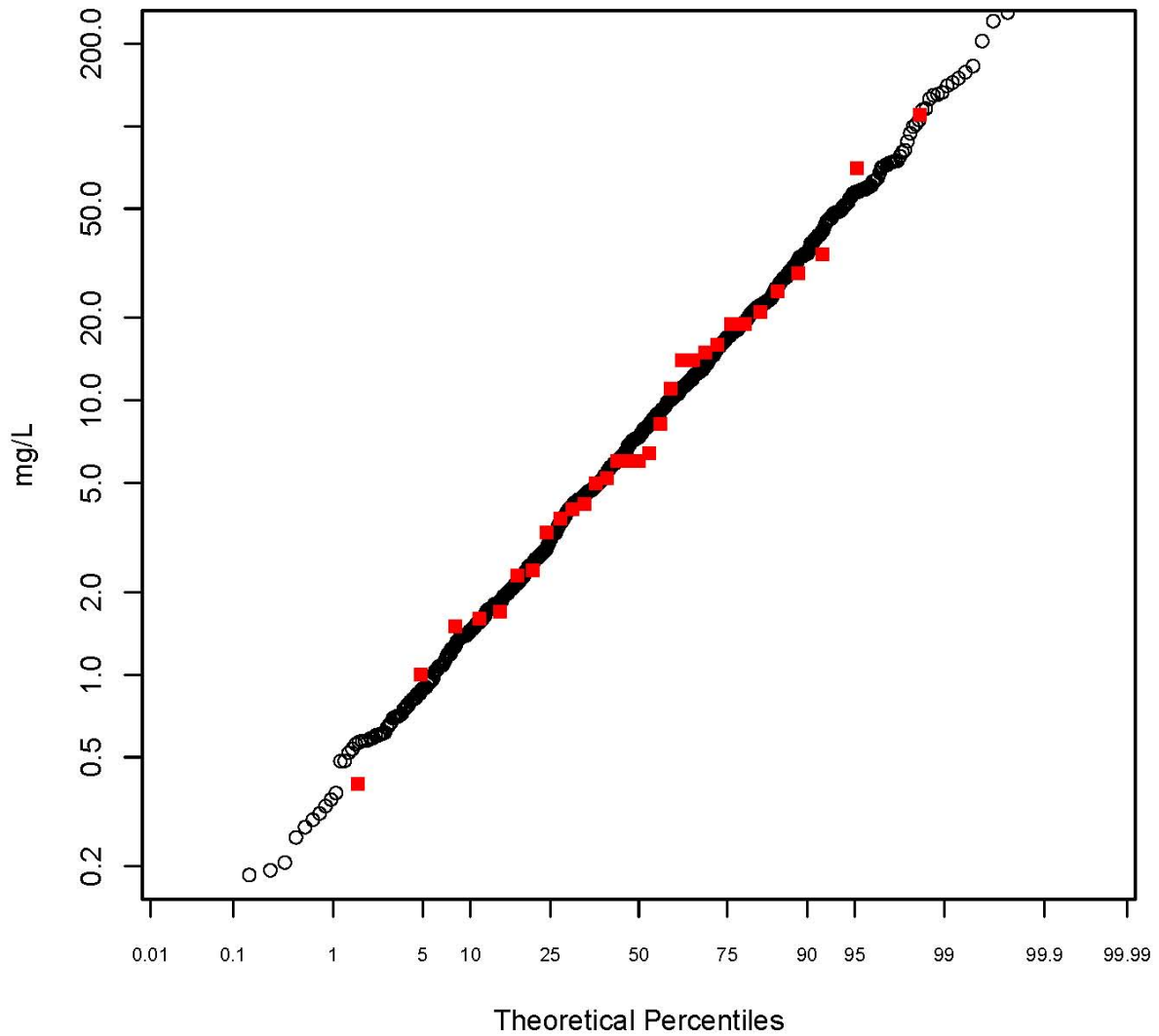
Q-Q Plot for Randomized and Sampled Orthophosphate



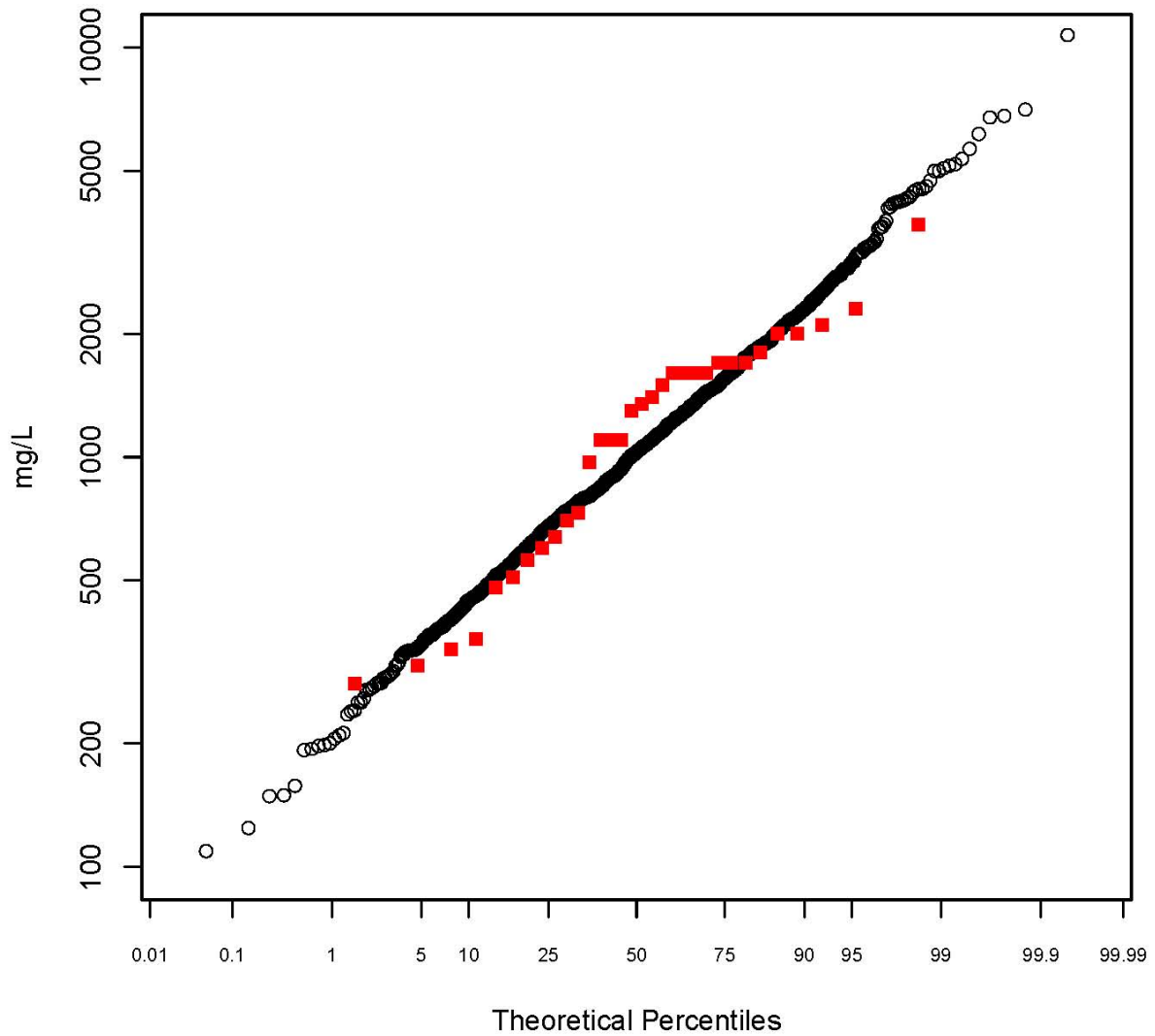
Q-Q Plot for Randomized and Sampled Total Dissolved Phosphorous



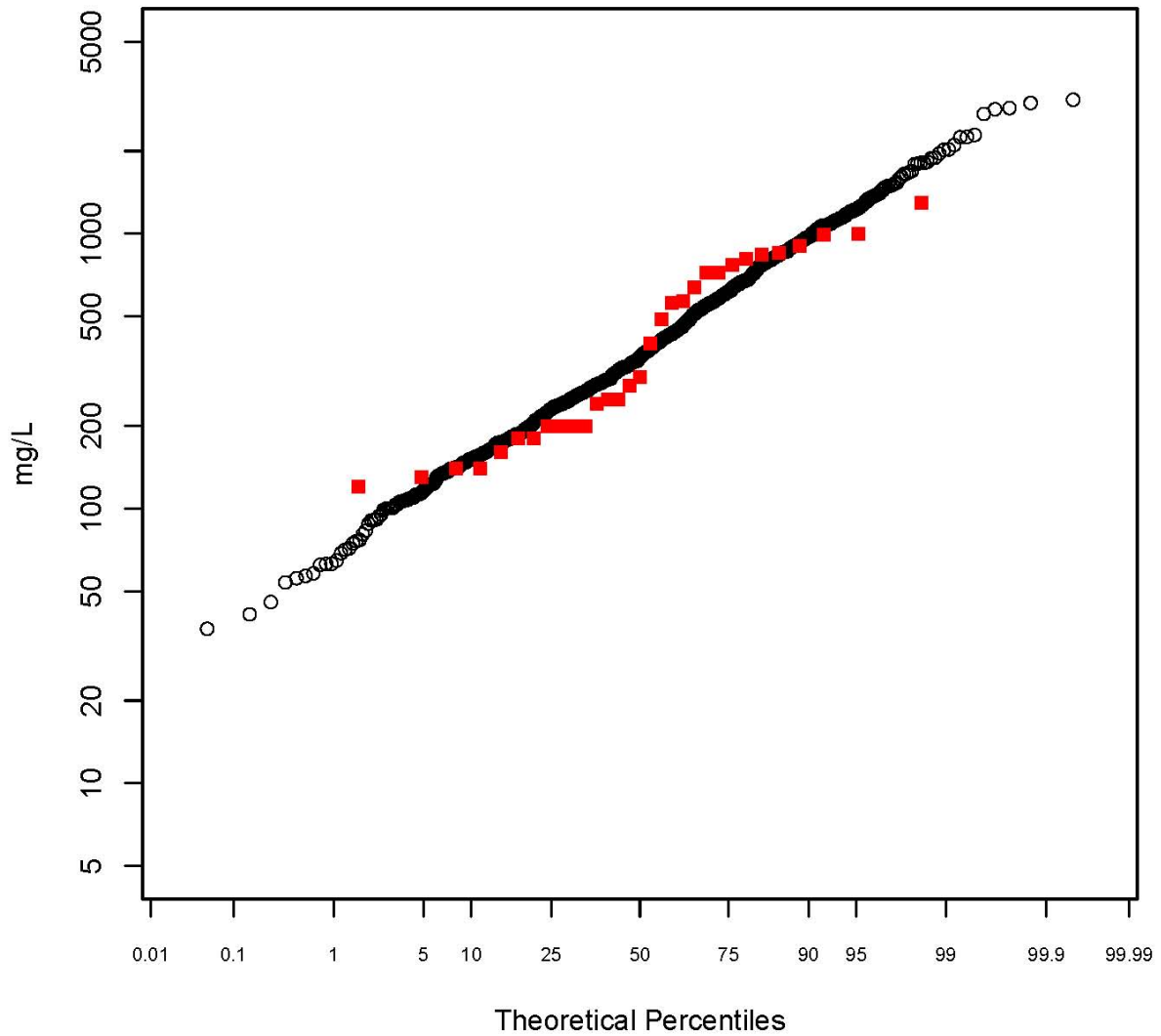
Q-Q Plot for Randomized and Sampled Total Suspended Solids



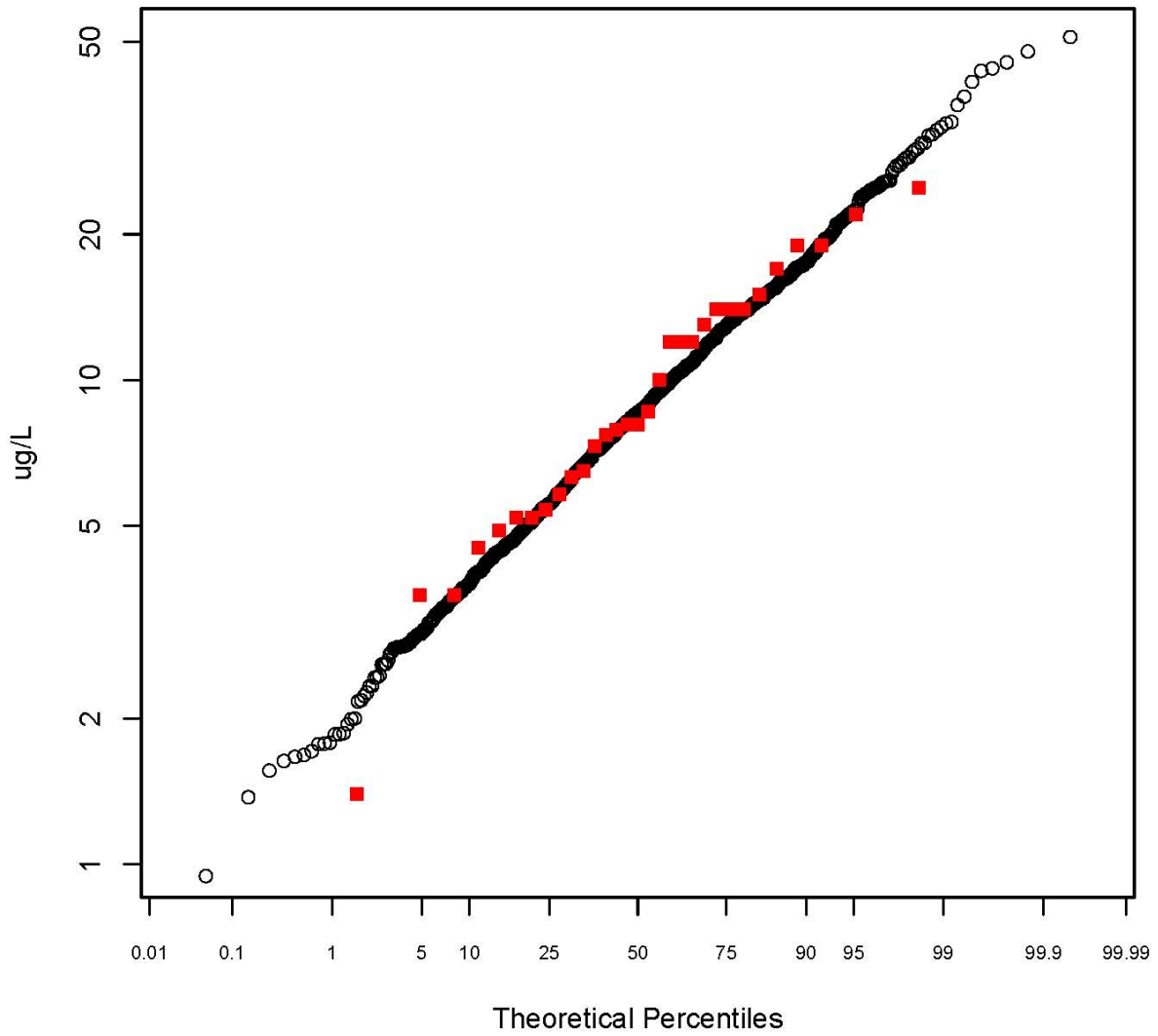
Q-Q Plot for Randomized and Sampled Total Dissolved Solids



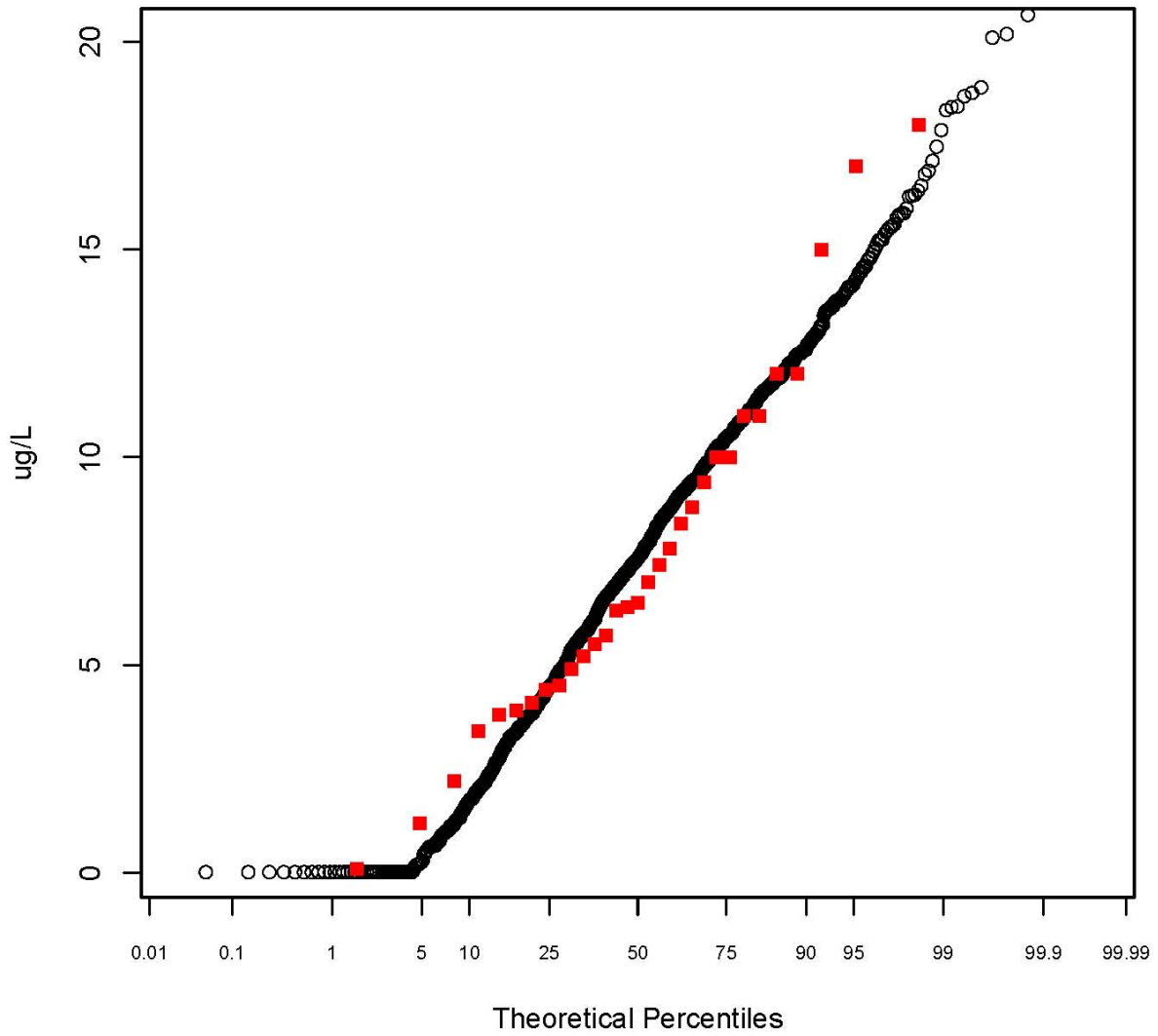
Q-Q Plot for Randomized and Sampled Hardness



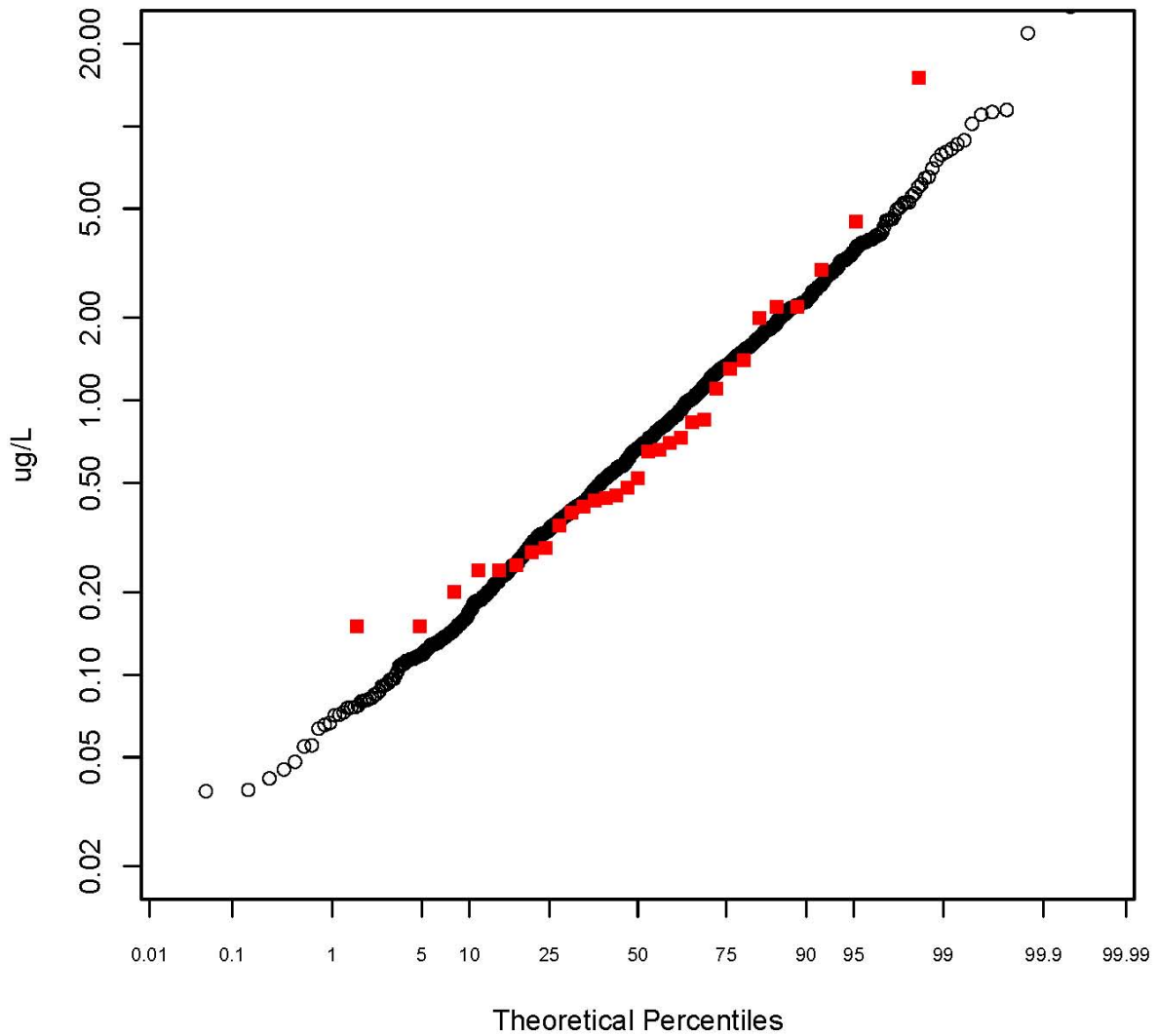
Q-Q Plot for Randomized and Sampled Total Copper



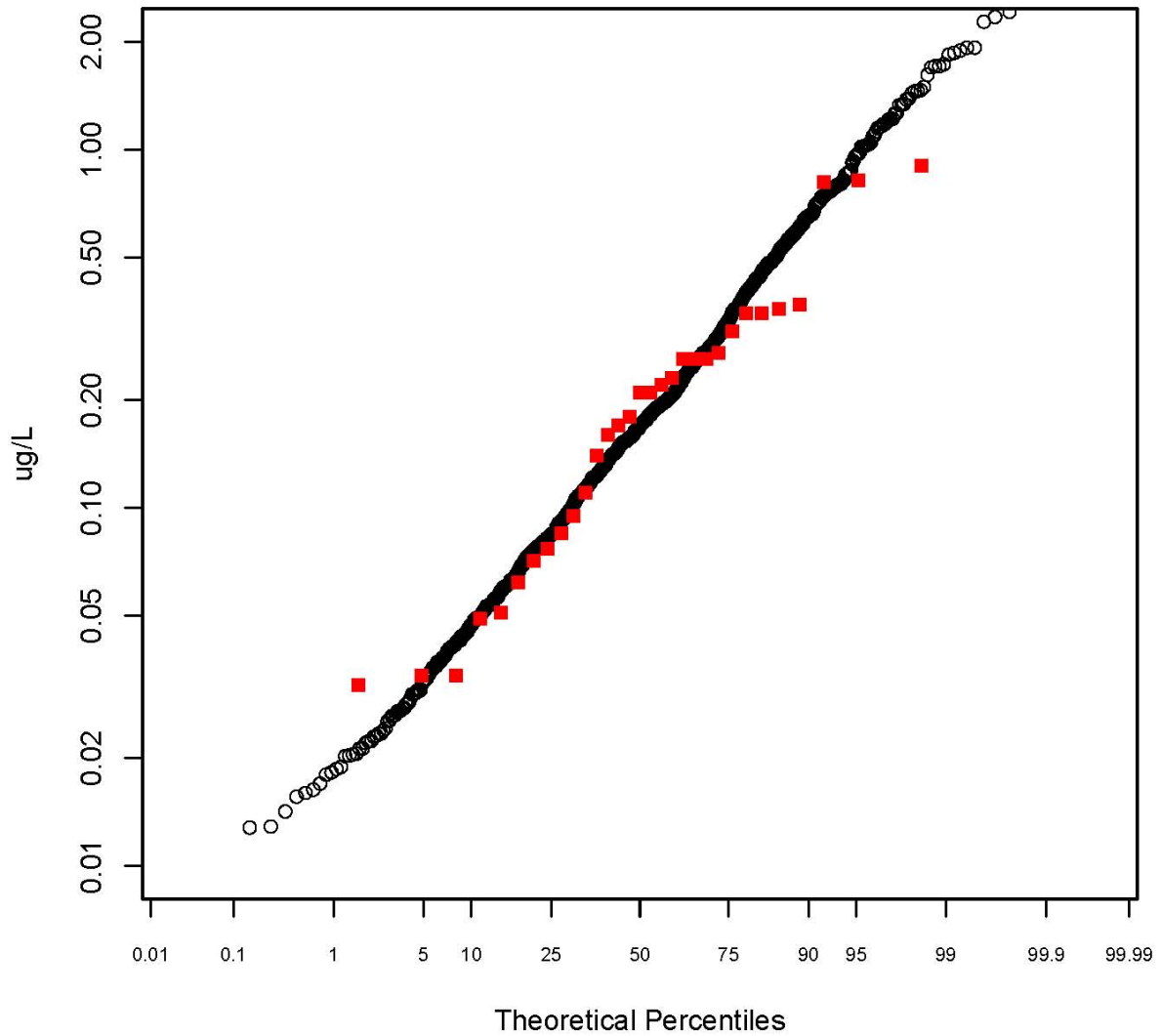
Q-Q Plot for Randomized and Sampled Dissolved Copper



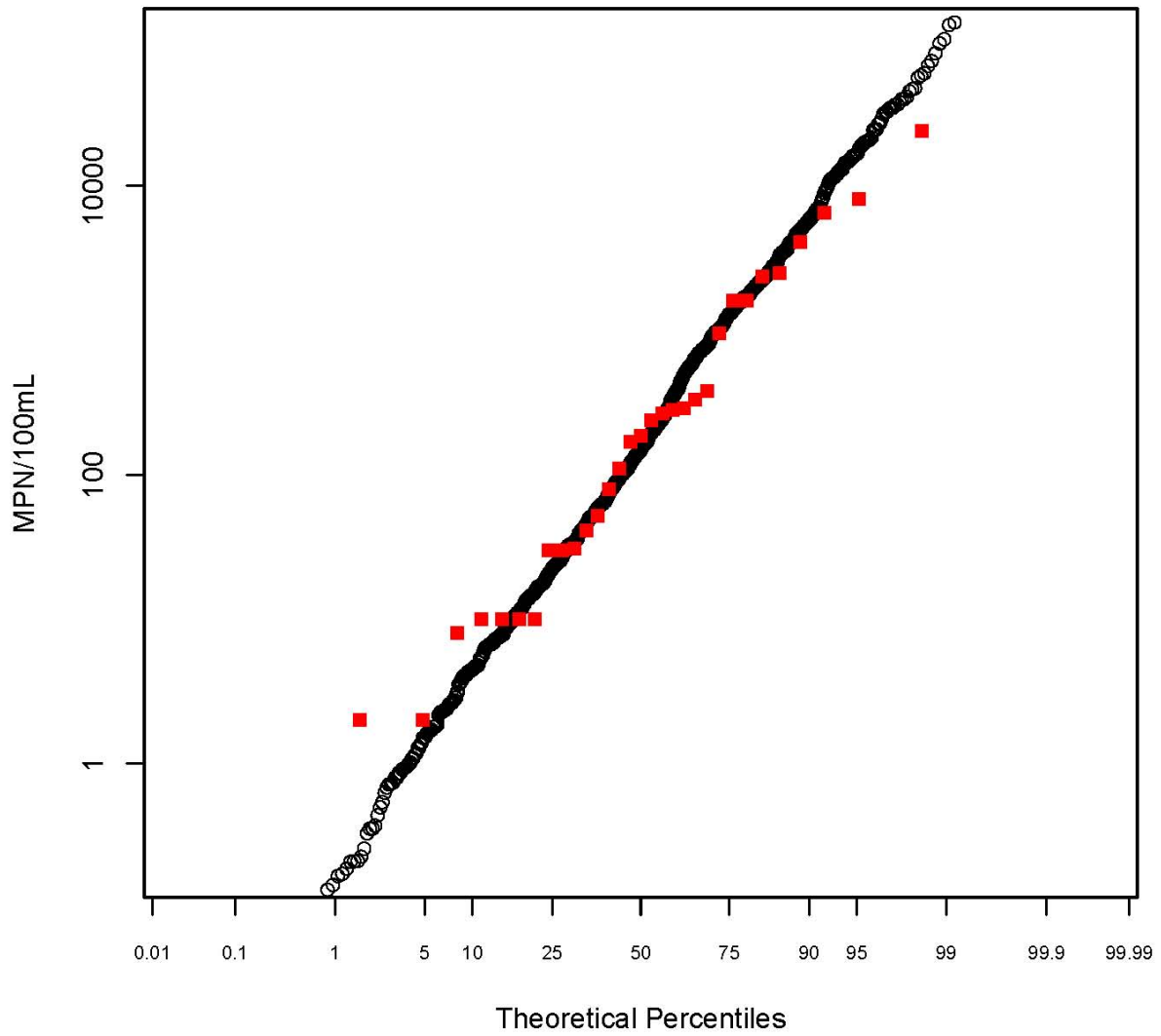
Q-Q Plot for Randomized and Sampled Total Lead



Q-Q Plot for Randomized and Sampled Dissolved Lead



Q-Q Plot for Randomized and Sampled E. Coli



Appendix H-1 Calculations Regarding Loading Rate Scaling to County Island Areas and Monte Carlo Simulations

Generation of Simulated Constituent Loading Rates per Site

Loading rate is considered to be the product of the estimated dry weather flow and the estimated water quality concentration. A concentration value was generated from the constituent distribution for each record of dry weather flow rate for each individual site. As each site has a different length of flow records, a different set of randomized concentration data is generated for each site. All loading rates were converted to kilograms per year, or MPN per year in the instance of *E. coli*. To determine a single value for a site's loading rate, the average across the length of the data set was taken. The average was found to be an appropriate value that would appropriately account for occasional instances of dry discharges resulting in loading rates of 0.

Scaling Site Loading Rates to County Land Areas

Following the generation of an average site loading rate, each outfall had to be scaled to the percentage of its unique drainage area that was owned by the County. This was done to avoid accounting for loading for which other entities are responsible. The decision to base loading rates as a function of land area stems from the Regional Board's decision to assign waste load allocations to permittees by percentage of land area owned within the watershed. Maps of the County-owned areas and the site drainage areas were reviewed in ArcGIS, and the areas (in square miles) calculated within the program and Microsoft Excel.

Drainage areas for 1O_ACAD and 1O_EAST are both 100% in county. Therefore no scaling was applied to these individual sites.

County Island 3 inflow sites, per their objective as measures of inflow, have very little drainage area that is within County-owned land. The drainage area for 3I_NORMP has 0.069958 square miles of County land in a total area of 2.142888 square miles, which results in a scaling factor of 3.26466 percent. The drainage area for 3I_ASHB has 0.074189 square miles of County land in a total area of 0.381187 square miles, which results in a scaling factor of 19.46263 percent.

The drainage area for 3O_VAND has 0.506385 square miles of County land in a total area of 1.031168 square miles total, which results in a scaling factor 49.1079 percent.

The drainage area for 3O_VERSEP is actually the combined drainage areas of 3I_ASHB, 3I_NORMP, and the drainage area unique to 3O_VERSEP that is 100% within the County. To avoid double-counting the loading provided by the inflow sites, they must be factored in to 3O_VERSEP's scaling. The drainage area unique to 3O_VERSEP is 0.309971 square miles. Combined with the drainage areas of the two County Island 3 inflow sites, the entirety of 3O_VERSEP's drainage area is 2.834046 square miles, which results in a scaling factor of 10.9374019 percent.

These scaling factors are applied to the individual site loading rates calculated above, then summed to create an estimation of loading rates from County-owned land monitored by the sampling sites.

Scaling-Summed Site Loading Rates to All Discharging County Land Areas

To generate a mass-based loading estimate that applies to all County lands, drainage areas for which samples were not taken must be considered. To scale the previous estimate from County-owned land monitored by the sampling sites up to all County-owned land discharging to Machado Lake, the estimate is multiplied by a factor representing the percentage of areas not covered by monitoring within the study. Maps of the County-owned areas and the site drainage areas were reviewed in ArcGIS, and the areas (in square miles) calculated within the program and Microsoft Excel.

The area comprising County Island 1 is 0.52178 square miles, while the area comprising County Island 3 is 1.269753 square miles. Both areas contribute to dry weather discharges to Machado Lake. The land area for County Island 2 was not added to the summation, as it was observed over the course of the study that the Island did not contribute to dry weather flows. This totals 1.793931 square miles of County land that discharges to Machado Lake. Dividing this by the sum of the monitoring sites' drainage areas within County land, a total of 1.248004 square miles (0.2875 square miles from County Island 1 and 0.9605 square miles from County Island 3) resulted in a scaling factor of 143.744 percent.

Overall, the resulting final calculation for County Land loading rates is as follows:

$$Load_{Lake} = (Load_{1O_ACAD} * 1 + Load_{1O_EAST} * 1 + Load_{3I_ASHB} * 0.1946263 + Load_{3I_NORMP} * 0.03326466 + Load_{3O_VAND} * 0.491079 + Load_{3O_VERSEP} * 0.109374019) * 1.437440104$$

With the loading for the individual sites calculated as:

$$Load = \frac{\sum_{i=1}^n (Dryflow[i] \times Concentration)}{n} \times K$$

Where:

Load = The loading rate in kilograms per year

Dryflow = The record of dry weather flow rates

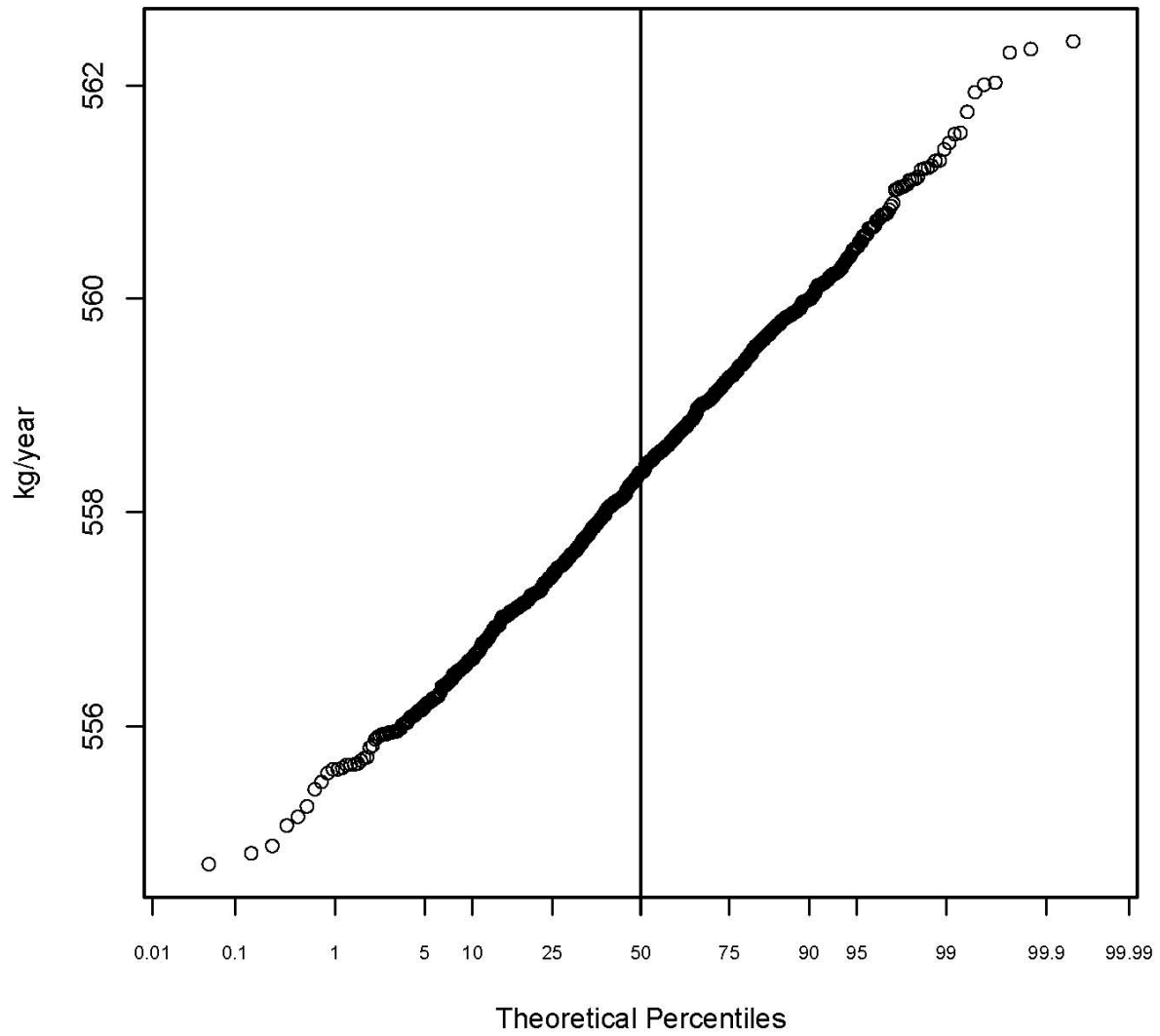
Concentration = a random water quality constituent concentration selected from a predefined distribution sample

n = the length of the dry weather flow rate record, and

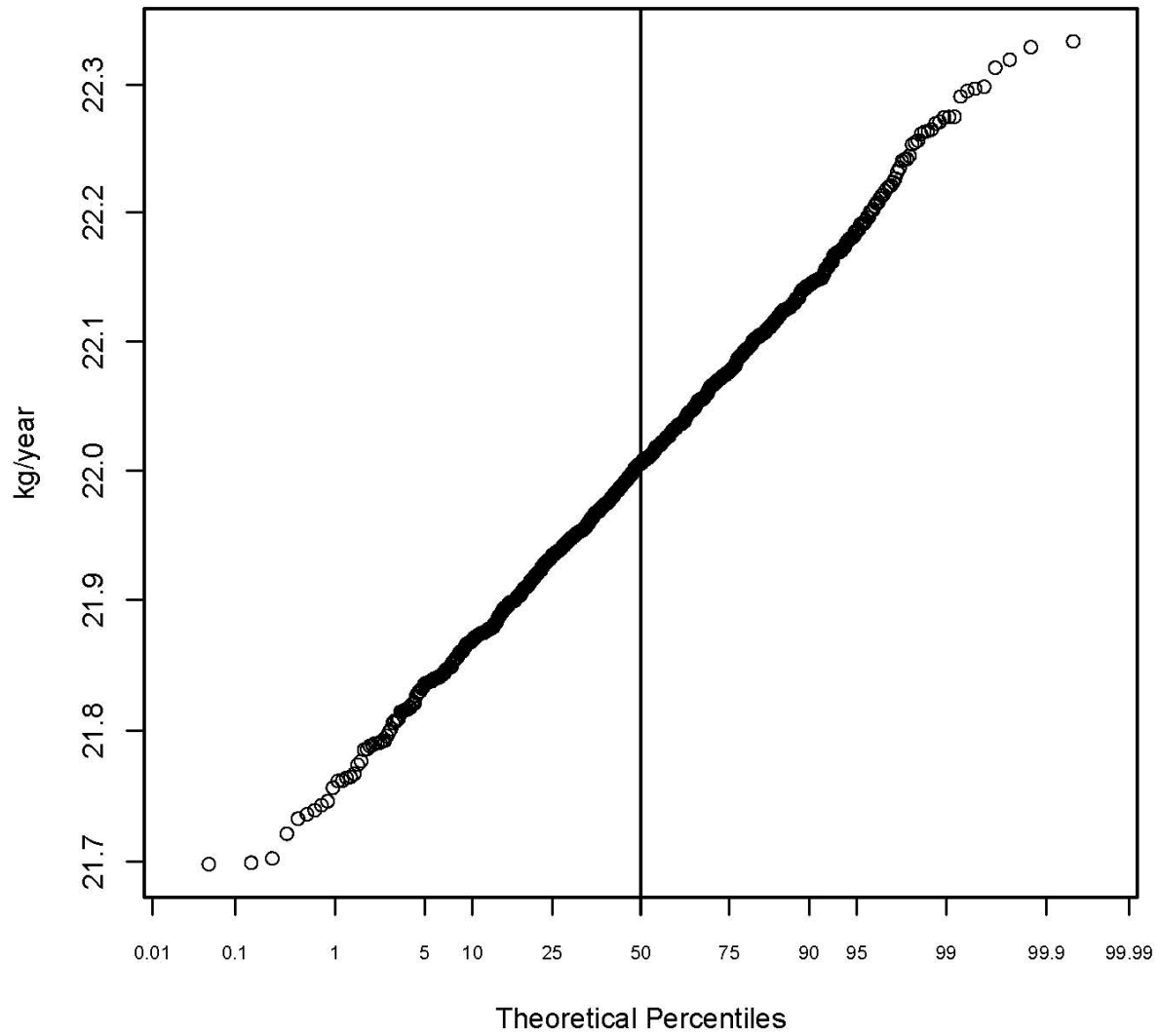
K = a conversion factor, as necessary, converting to kilograms per year or most probable number per year.

Appendix H-2 – Mass-Based Loading Estimate Simulation Results

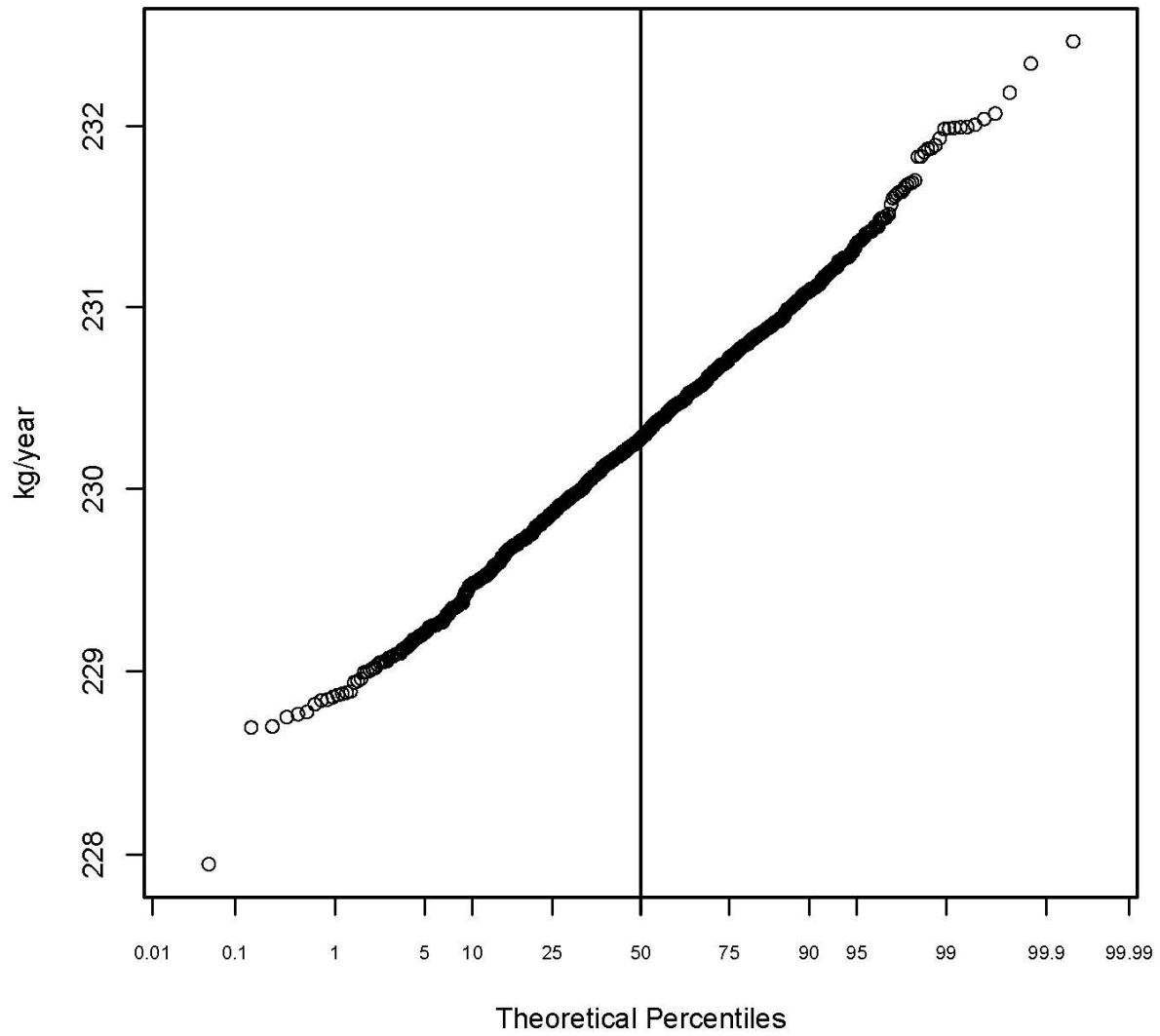
Q-Q Plot for Simulated Loadings of Total Nitrogen



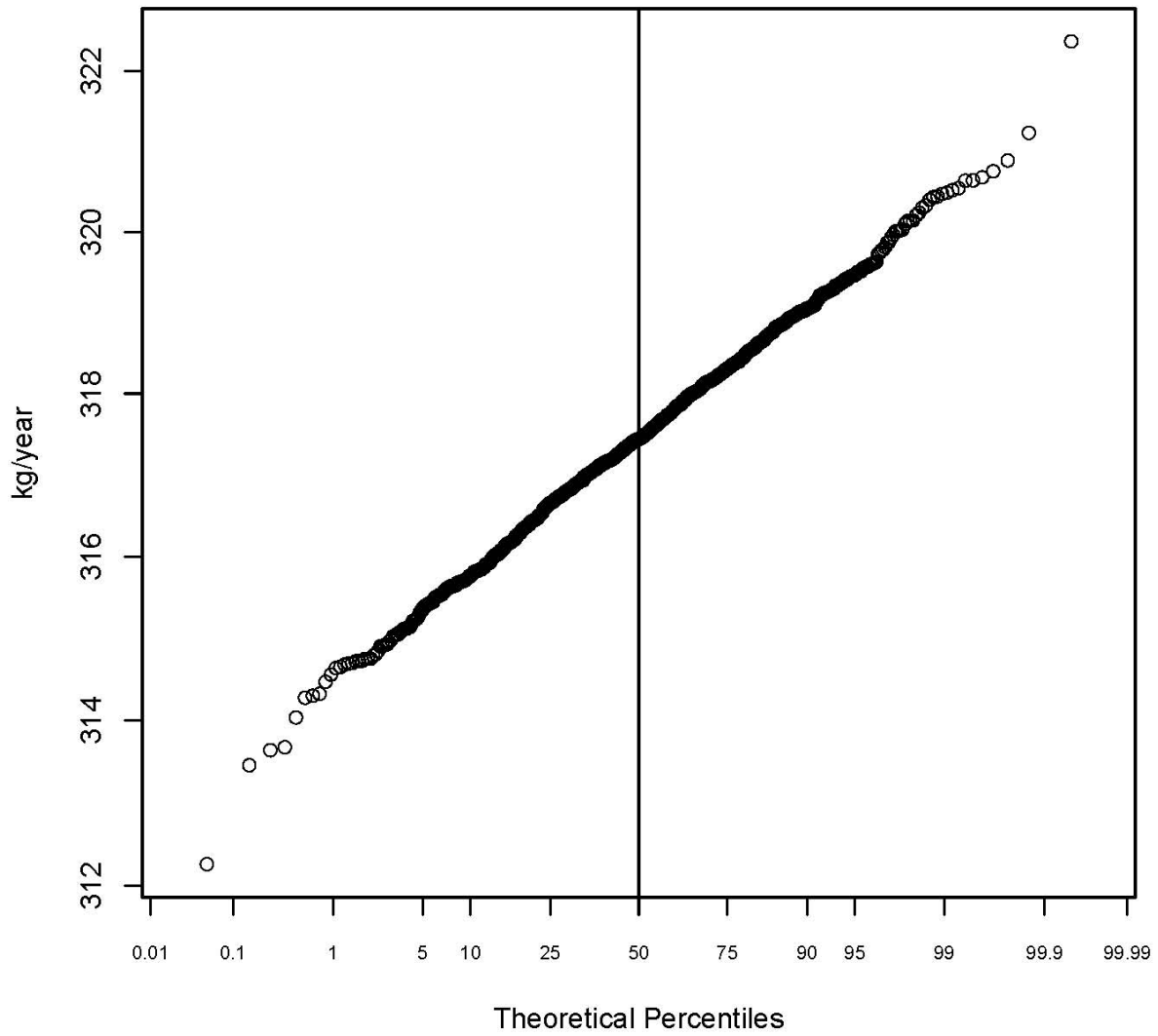
Q-Q Plot for Simulated Loadings of Ammonia



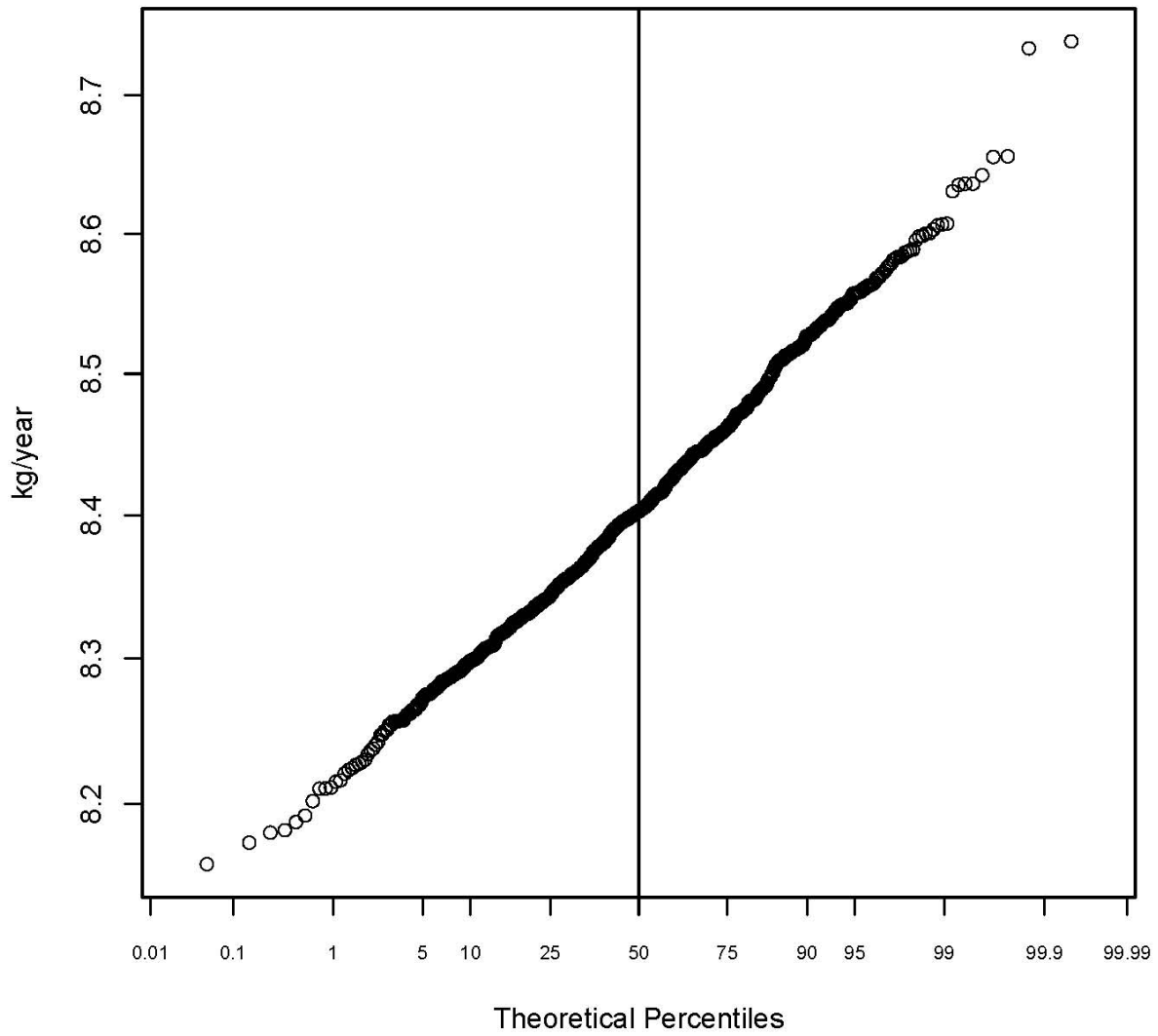
Q-Q Plot for Simulated Loadings of Total Kjeldahl Nitrogen



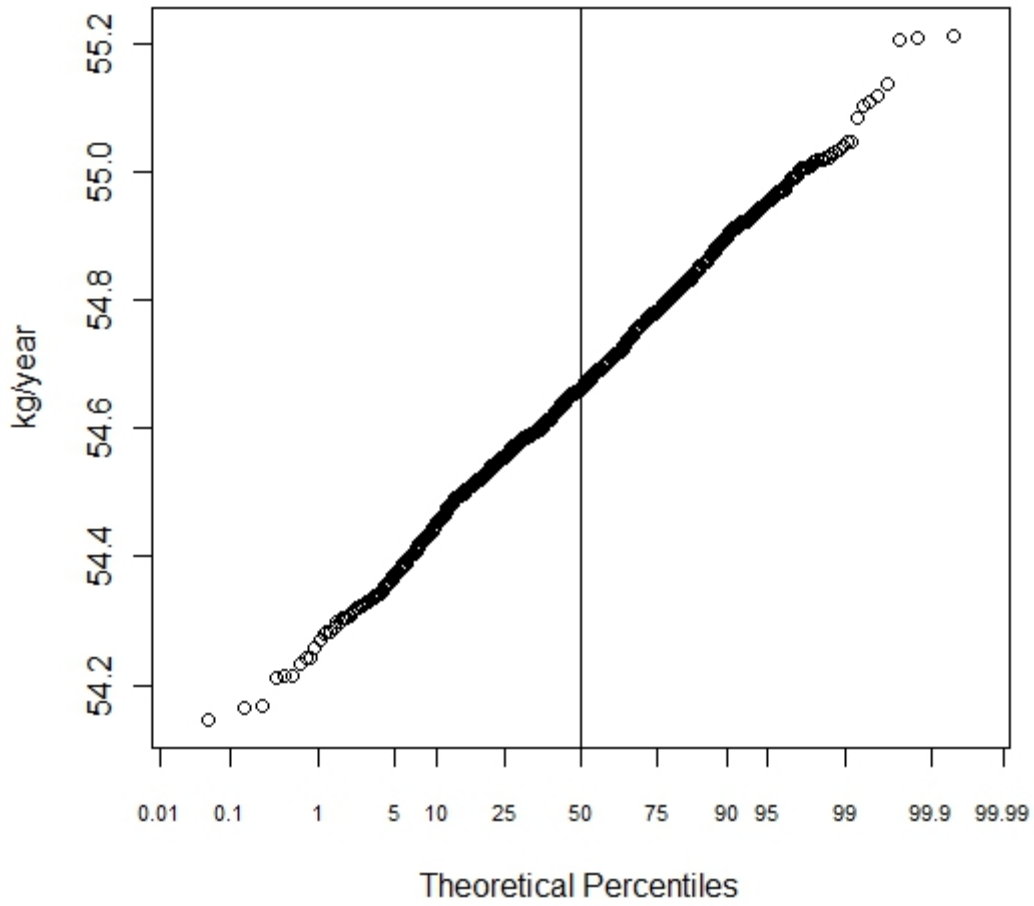
Q-Q Plot for Simulated Loadings of Nitrate



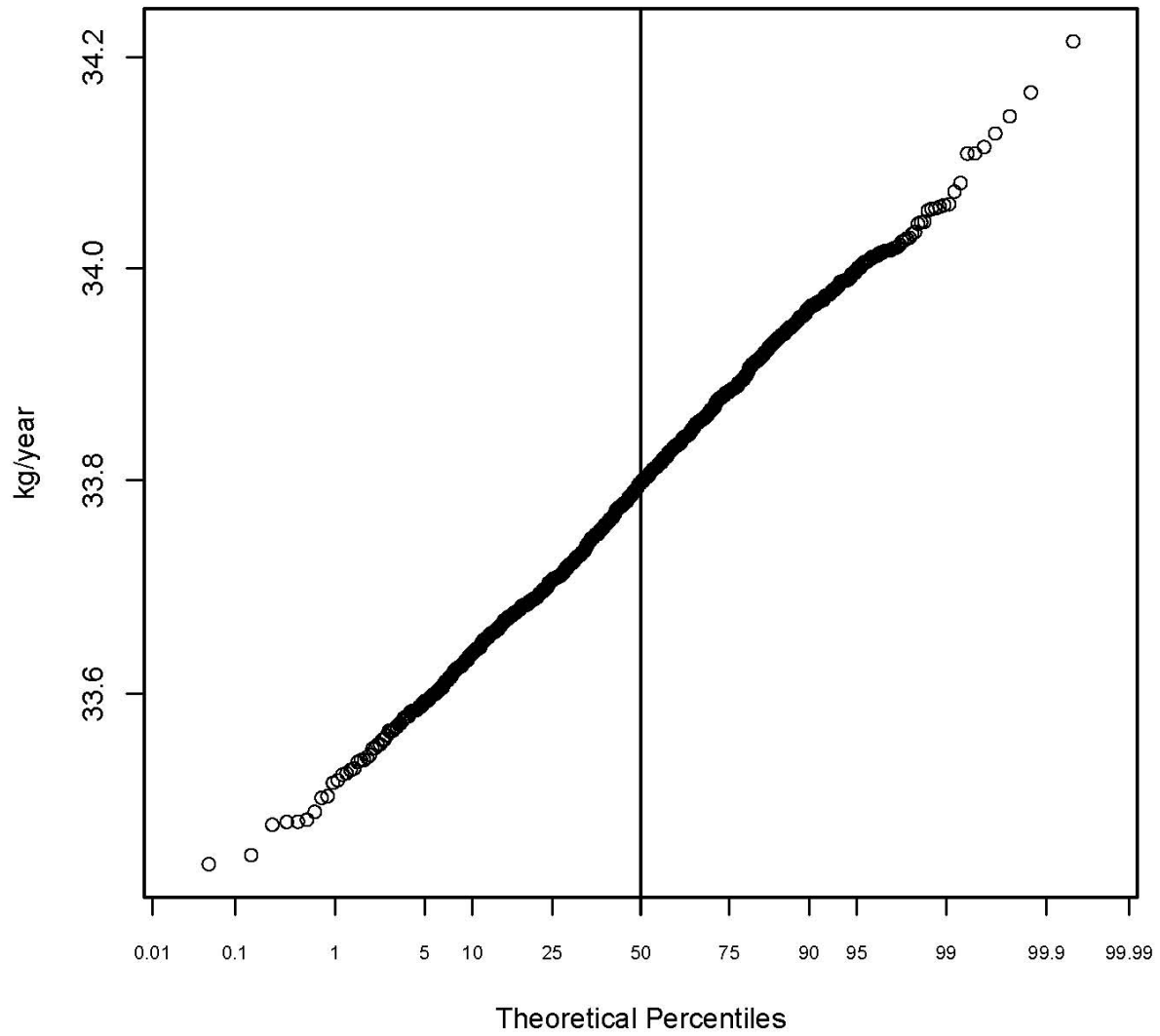
Q-Q Plot for Simulated Loadings of Nitrite



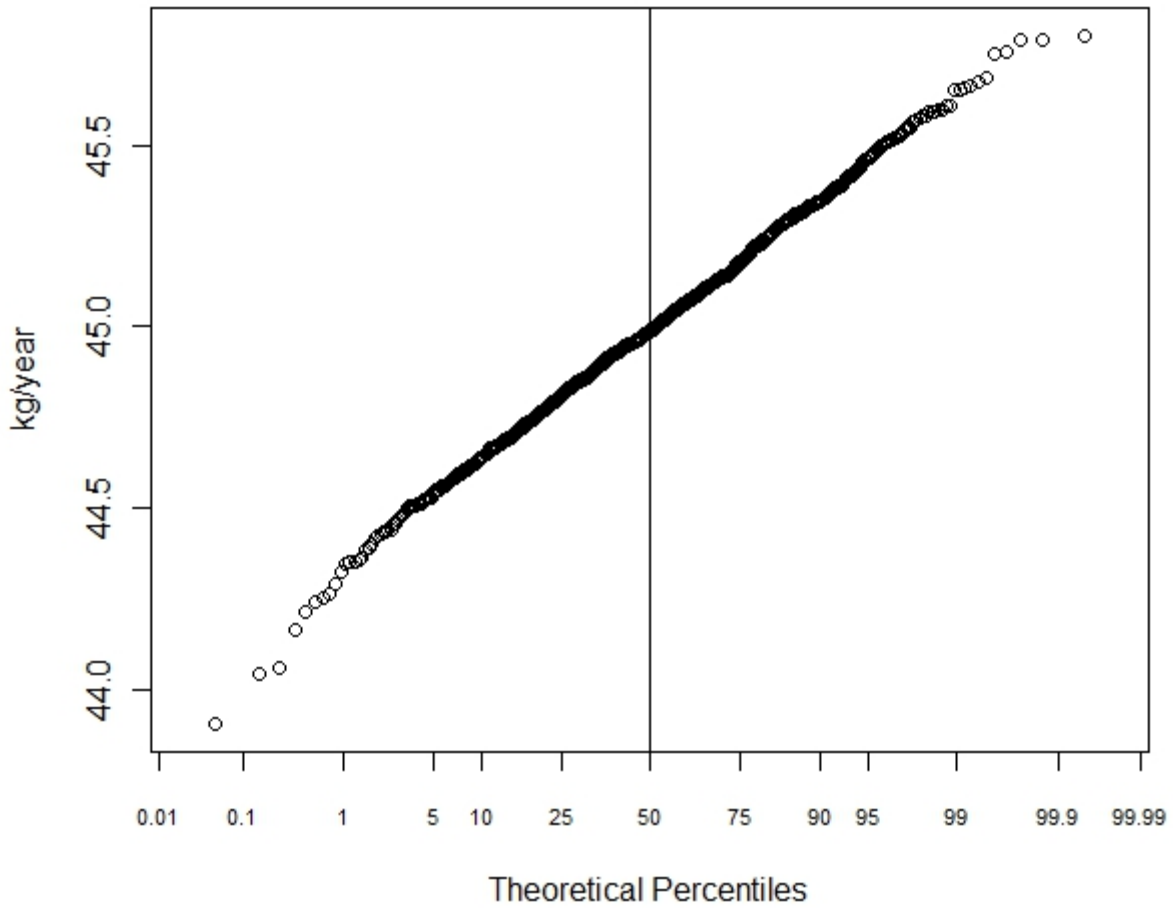
Q-Q Plot for Simulated Loadings of Total Phosphorous



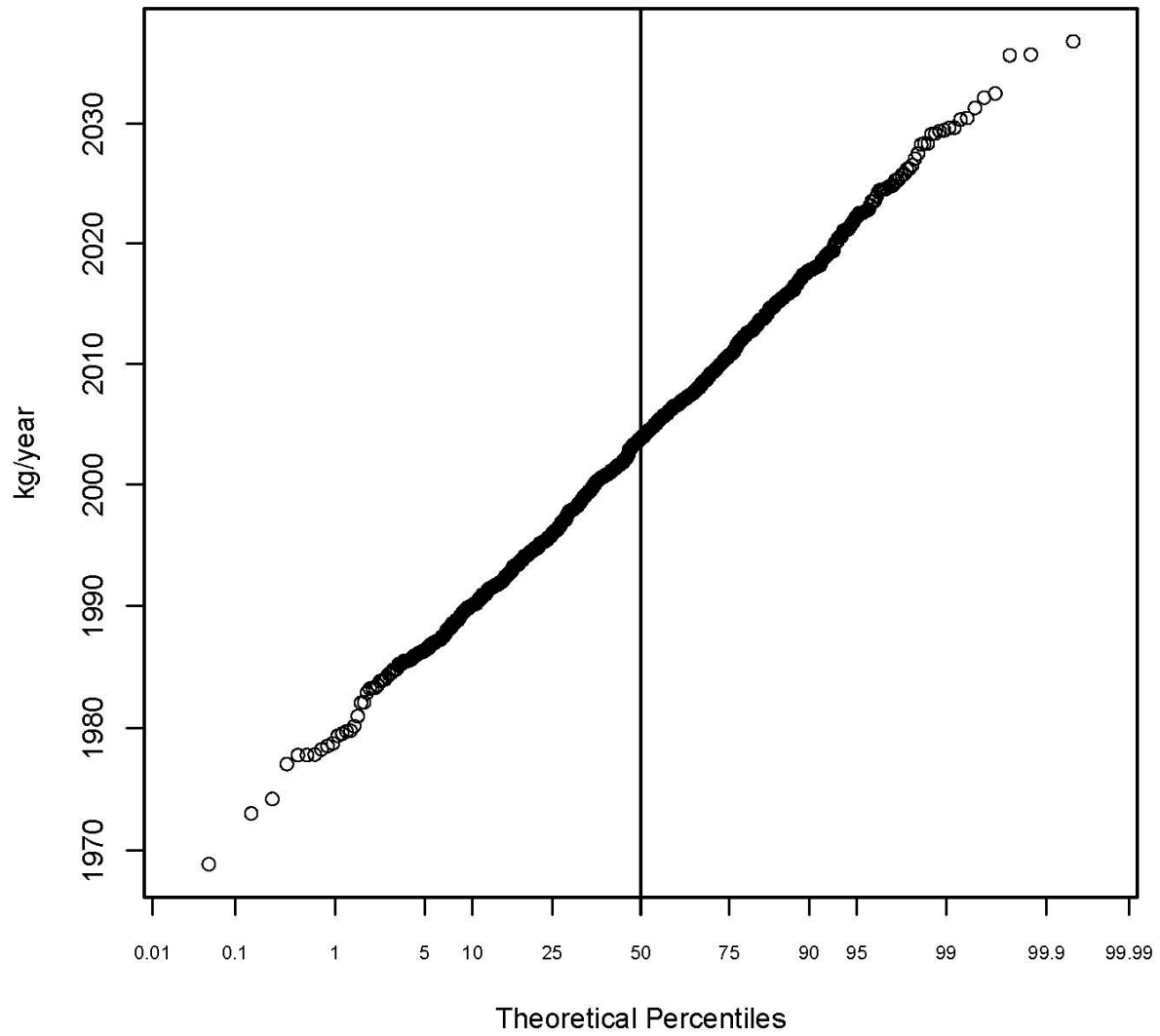
Q-Q Plot for Simulated Loadings of Orthophosphate



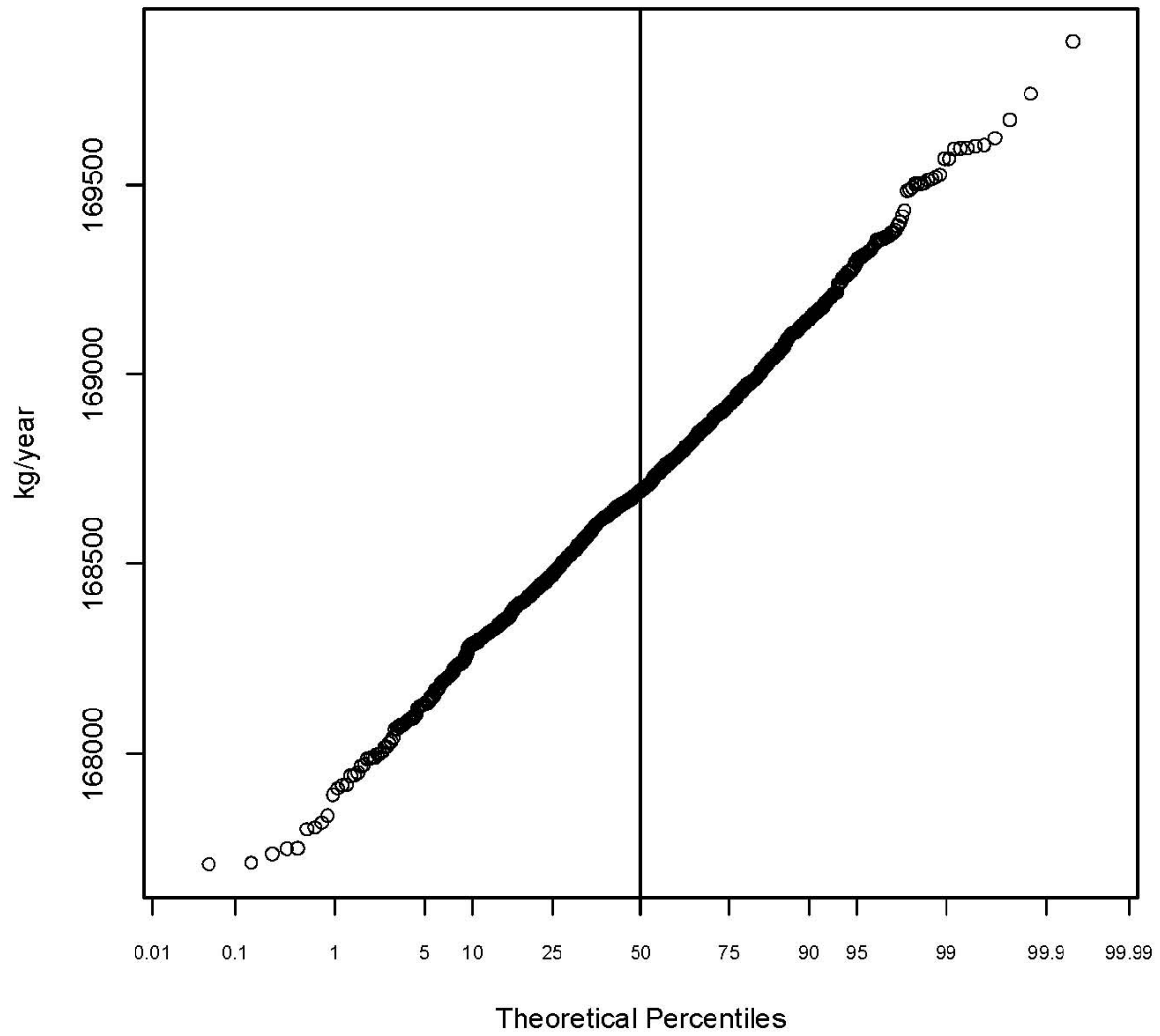
Q-Q Plot for Simulated Loadings of Dissolved Phosphorous



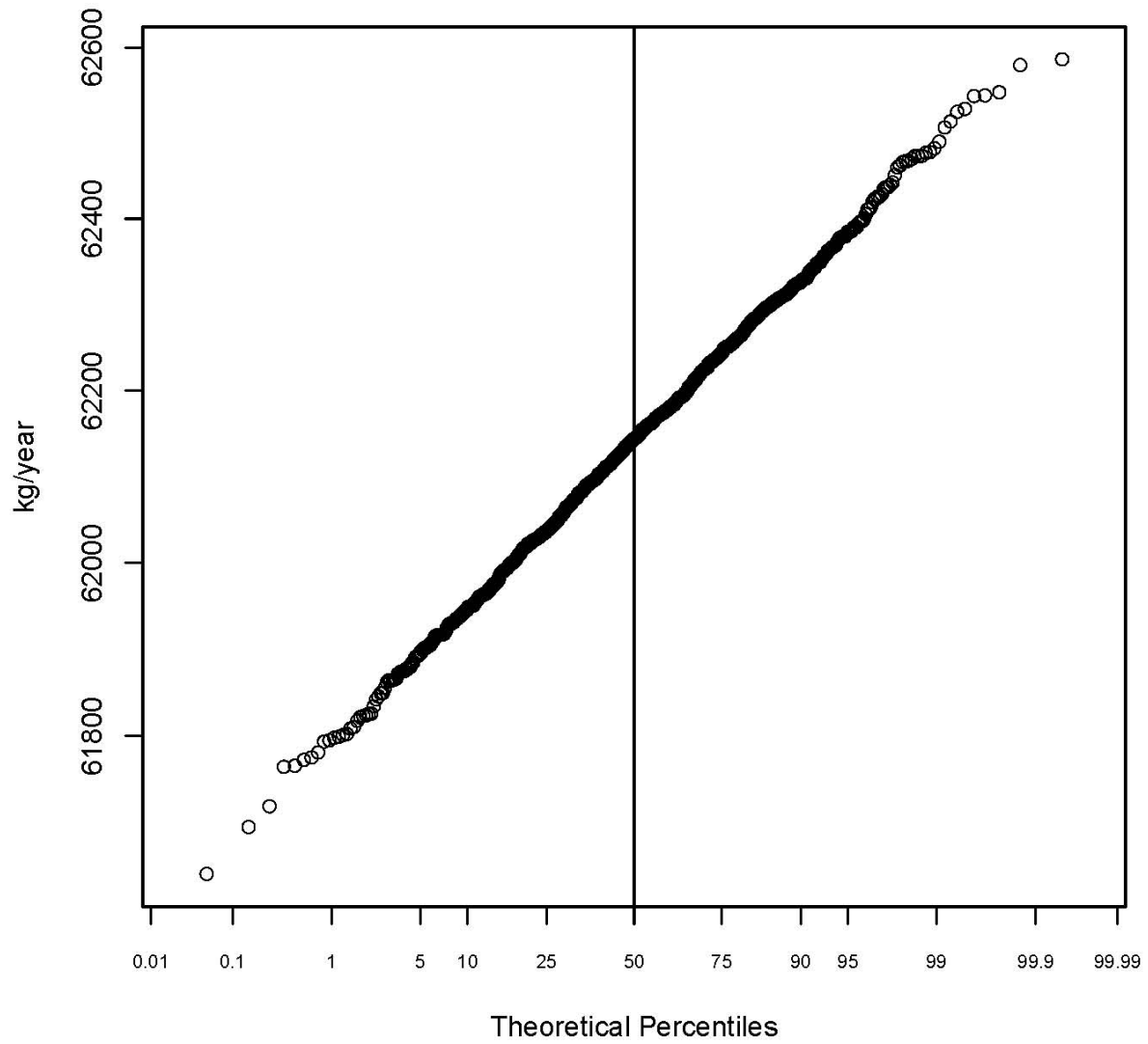
Q-Q Plot for Simulated Loadings of Total Suspended Solids



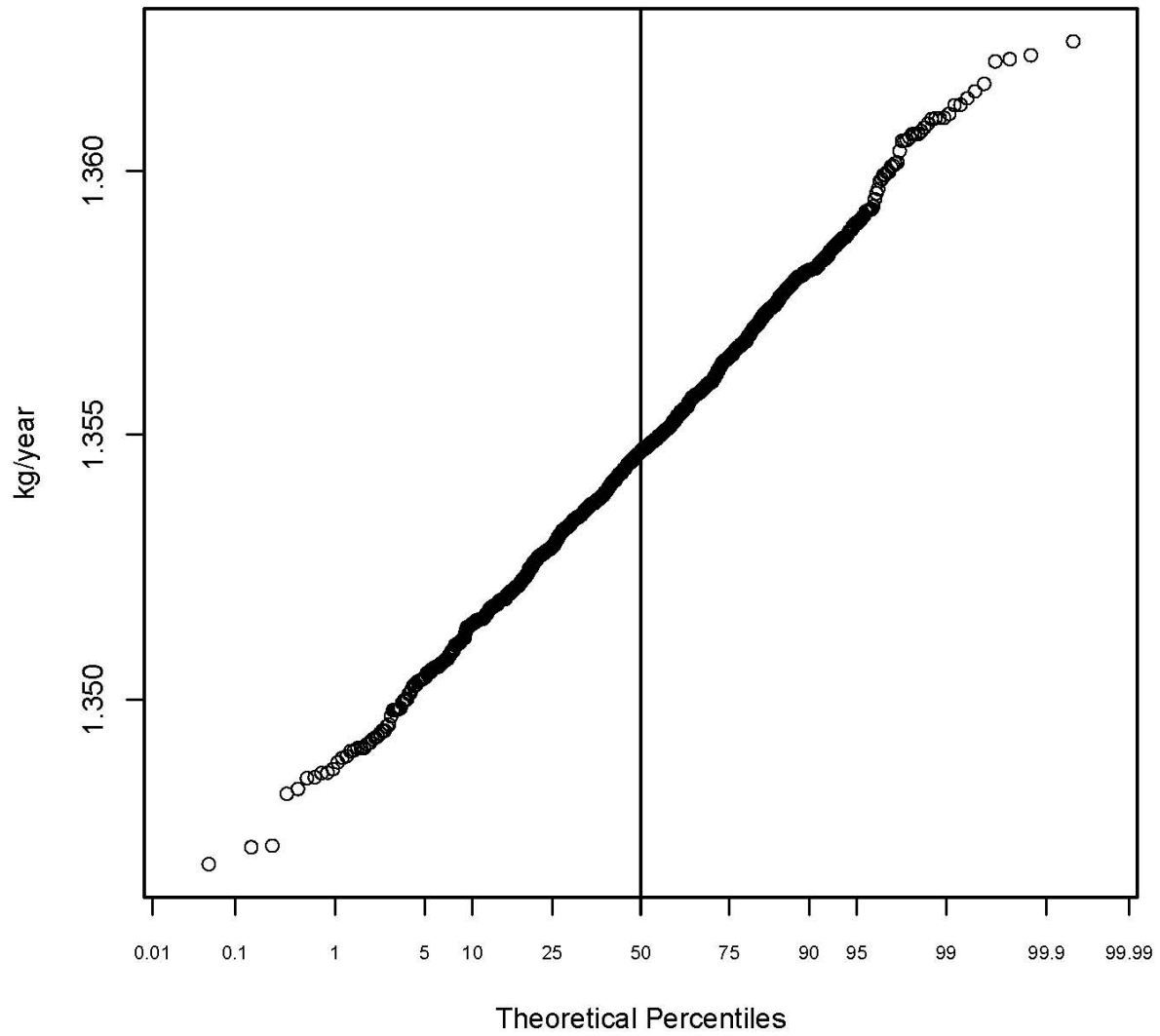
Q-Q Plot for Simulated Loadings of Total Dissolved Solids



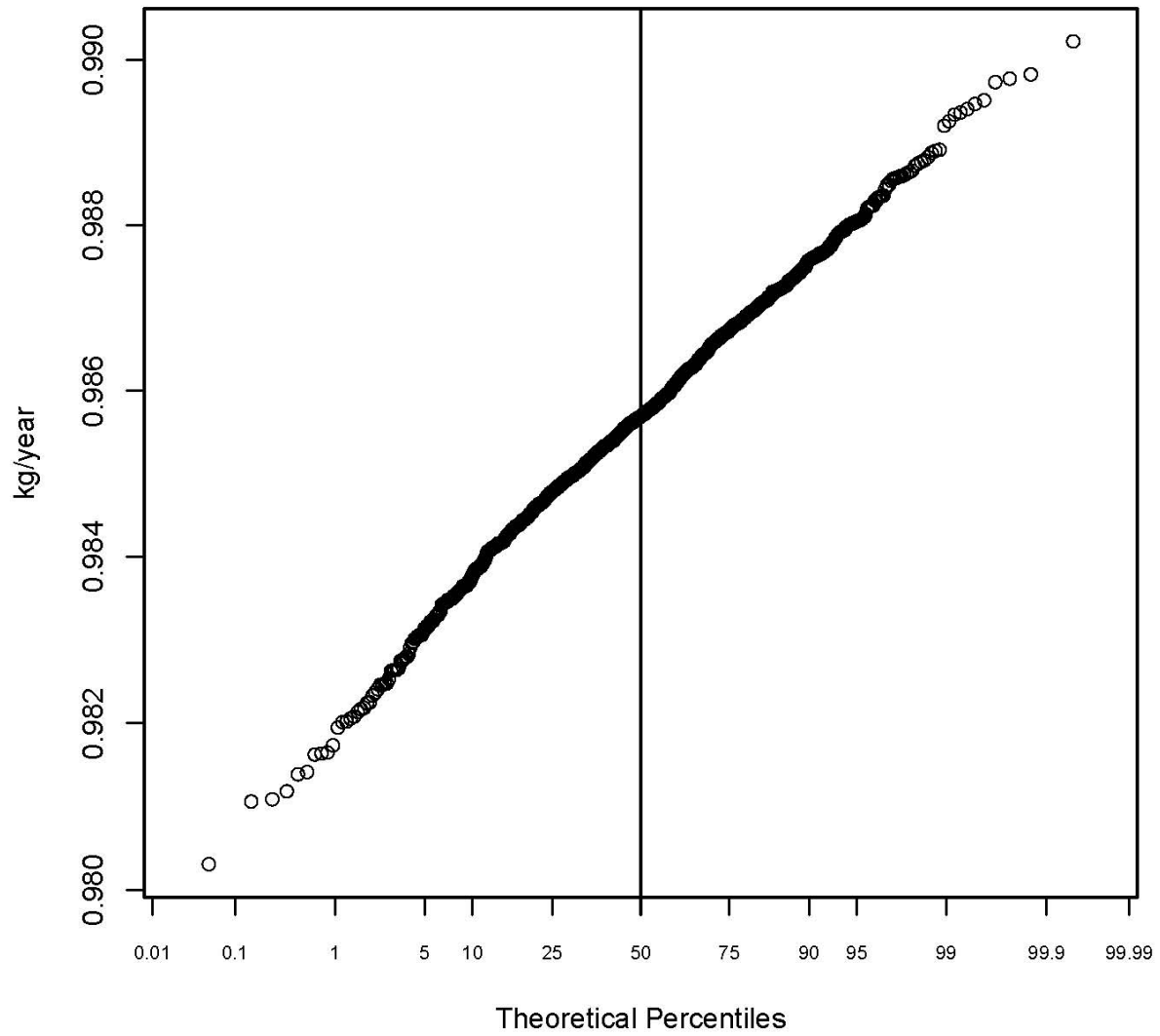
Q-Q Plot for Simulated Loadings of Hardness (as CaCO3)



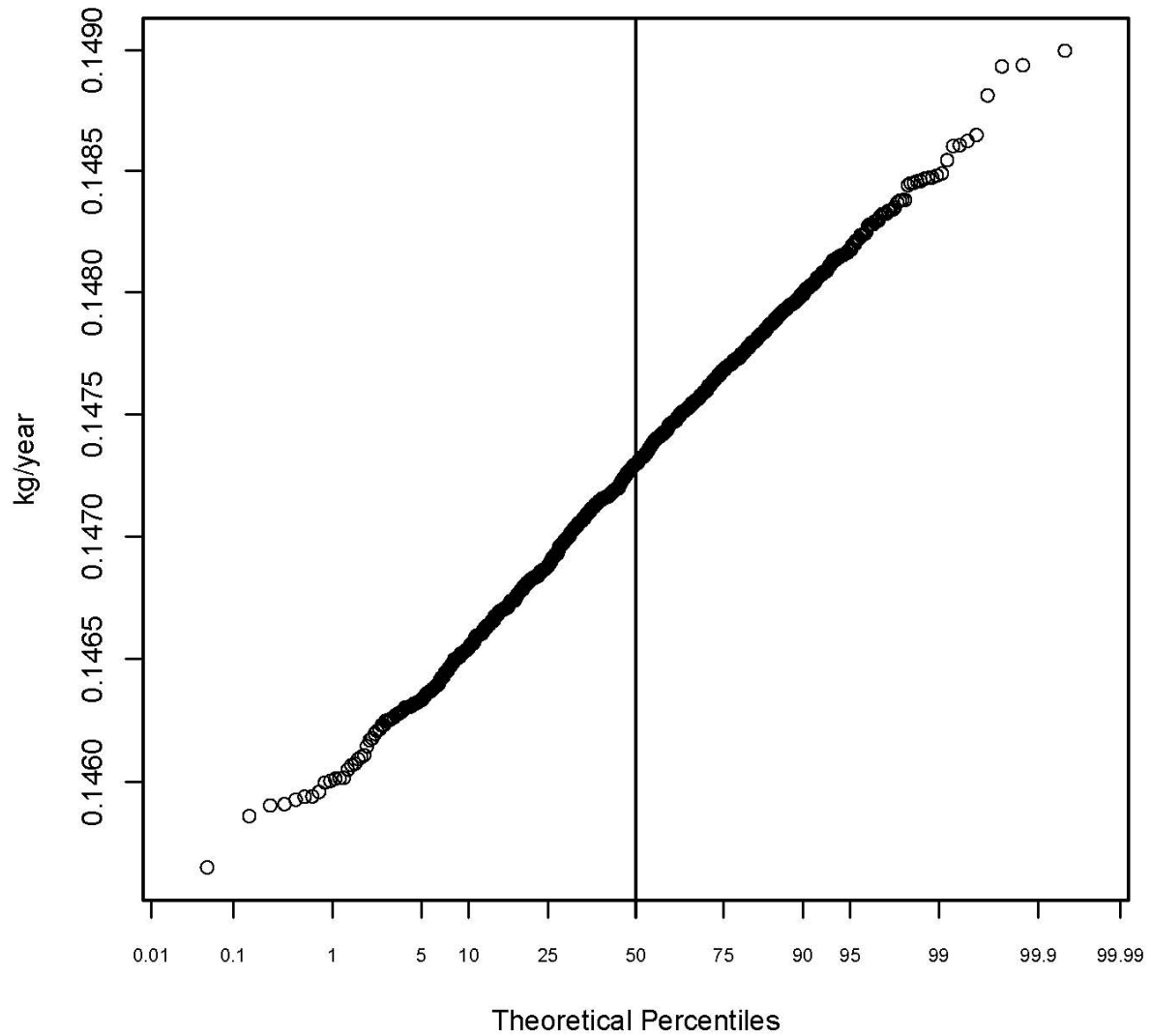
Q-Q Plot for Simulated Loadings of Total Copper



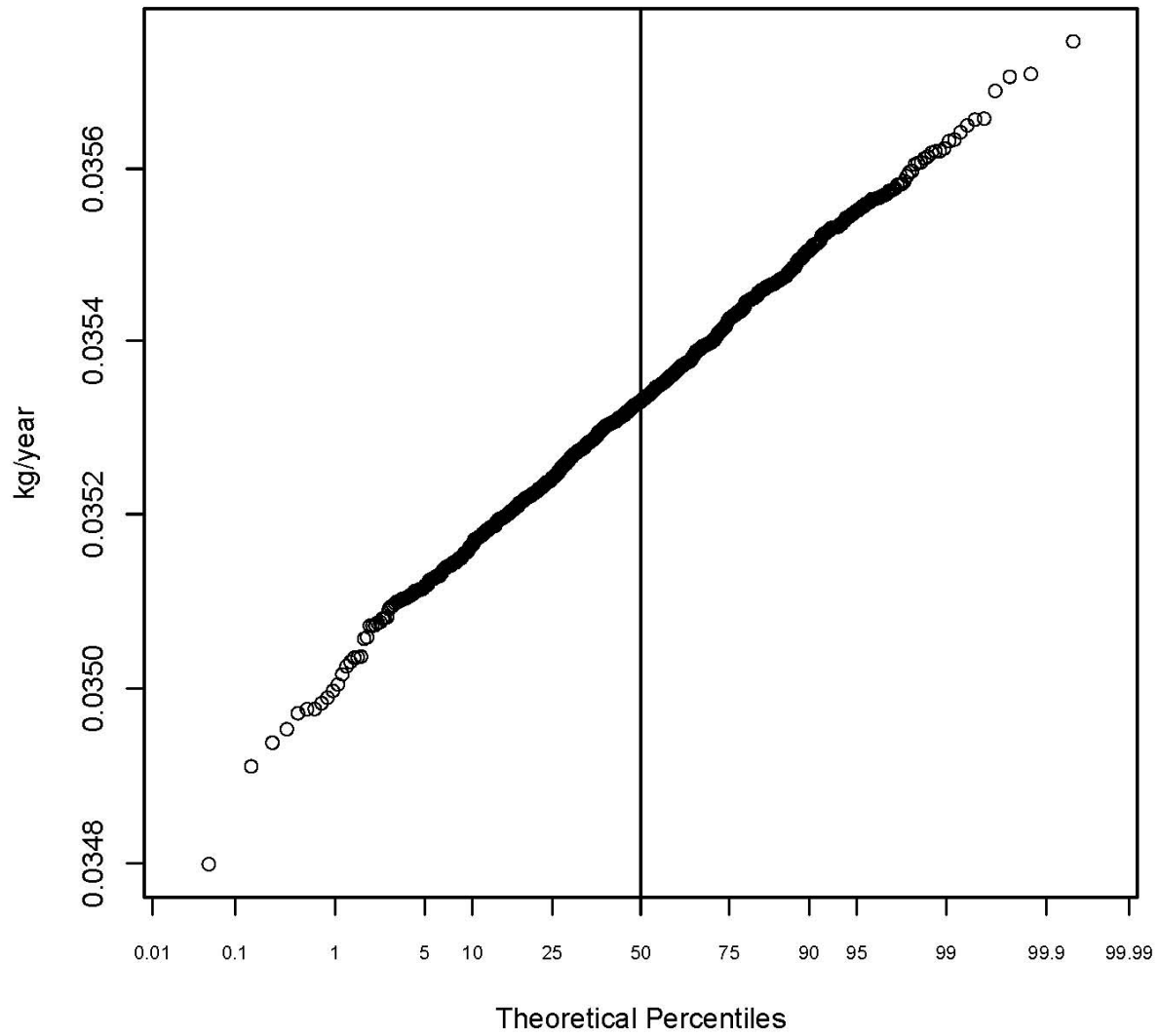
Q-Q Plot for Simulated Loadings of Dissolved Copper



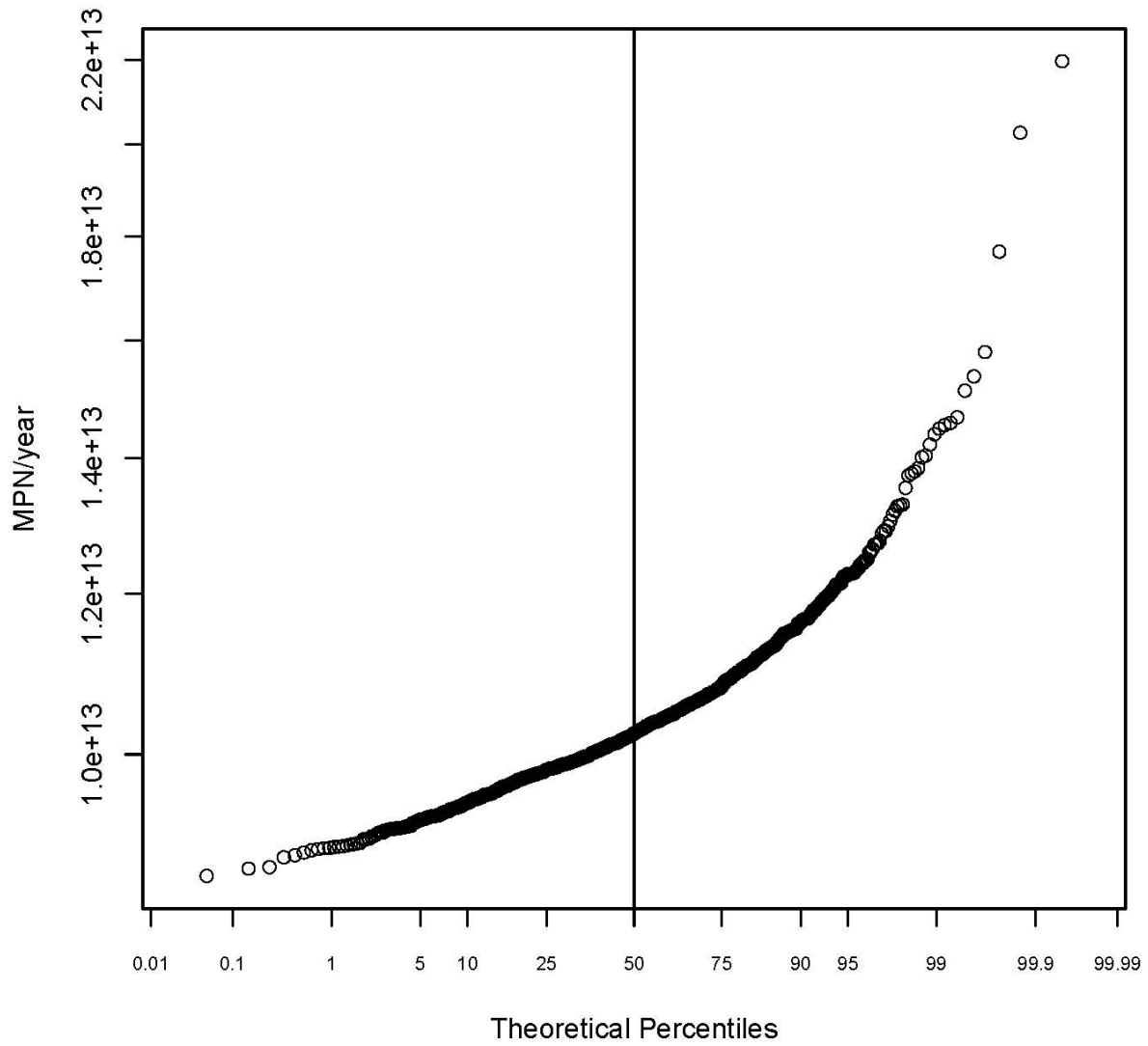
Q-Q Plot for Simulated Loadings of Total Lead



Q-Q Plot for Simulated Loadings of Dissolved Lead



Q-Q Plot for Simulated Loadings of E. Coli



Appendix I-1 - Annual Mass-Based Loading Estimates from WMMS Model

Table I-1-1: Annual Mass-Based Loading Estimates from WMMS Model

County Island #1	Area (acre)	TSS (kg/yr)	TN (kg/yr)	TP (kg/yr)	TZn (kg/yr)	TPb (kg/yr)	TCu (kg/yr)
Transportation	45.33	1933.19	53.88	26.95	7.25	0.77	0.77
Residential	197.10	179.47	113.38	107.73	11.68	1.25	1.25
Ind. Inst. & Comm.	44.46	232.48	95.29	60.86	8.21	0.30	0.65
Vacant/Agriculture	48.01	644.75	8.95	4.48	0.03	0.00	0.01
Total	334.90	2989.89	271.51	200.02	27.17	2.32	2.68

County Island #2	Area (acre)	TSS (kg/yr)	TN (kg/yr)	TP (kg/yr)	TZn (kg/yr)	TPb (kg/yr)	TCu (kg/yr)
Transportation	7.46	359.77	10.23	5.11	1.35	0.14	0.14
Residential	98.40	687.56	26.76	18.87	1.31	0.15	0.23
Ind. Inst. & Comm.	0.38	18.33	0.55	0.35	0.05	0.00	0.00
Vacant/Agriculture	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Total	106.26	1065.67	37.53	24.33	2.71	0.30	0.38

County Island #3	Area (acre)	TSS (kg/yr)	TN (kg/yr)	TP (kg/yr)	TZn (kg/yr)	TPb (kg/yr)	TCu (kg/yr)
Transportation	196.34	10827.44	283.76	141.93	40.60	4.33	4.33
Residential	435.61	12466.57	464.52	441.36	46.75	4.99	4.99
Ind. Inst. & Comm.	153.53	11000.83	306.99	304.77	39.82	2.89	3.92
Vacant/Agriculture	27.58	40.44	1.54	0.77	0.00	0.00	0.00
Total	813.07	34335.28	1056.80	888.83	127.17	12.21	13.23

County Island	Area (acre)	TSS (kg/yr)	TN (kg/yr)	TP (kg/yr)	TZn (kg/yr)	TPb (kg/yr)	TCu (kg/yr)
1	334.91	2989.89	271.51	200.02	27.17	2.32	2.68
2	106.26	1065.67	37.53	24.33	2.71	0.30	0.38
3	813.09	34335.28	1056.80	888.83	127.17	12.21	13.23
Total	1254.26	38390.84	1365.85	1113.18	157.05	14.83	16.29

Appendix I-2 - Derivation of Fractional Relationship between Total Suspended Solids Loading and Organic Compounds Loading

The study “Quantification of Organochlorine Pesticide and PCB Fractions in Sediments Loaded to Machado Lake” (Larry Walker Associates, 2011) reviewed several studies to identify an optimal relationship between toxic constituents and suspended sediment. The study determined that values relating Chlordane, Total DDT, DDE (all congeners), and Dieldrin loadings to Total Suspended Solids loadings were best represented by the median values of toxic constituents in sediment calculated from the Machado Lake Sediment Characterization Report performed in 2010. This study was used because it took sediment data from the impacted lake itself, was recent, and was of a statistically significant sample size. The median values for organic compound per mass of Total Suspended Solids are presented below in **Table I-2-1**.

Table I-2-1: Fractional Relationships between TSS and Organics Derived from Machado Lake Sediment Characterization Report.

Constituent	Measured Median Concentration per unit TSS (µg/kg)
Chlordane-alpha	2.3
Chlordane-gamma	3.2
Total Chlordanes	20
2,4'-DDD	2
4,4'-DDD	4.1
2,4'-DDE	4.4
4,4'-DDE	4.2
2,4'-DDT	2
4,4'-DDT	3.9
DDD Congeners	4.2
DDE Congeners	5.1
DDT Congeners	4
Total DDTs	5.8
Dieldrin	4.9
Total PCBs	58